The Gas Journal

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Editorial Notes

"A.G.W.U.L."

A FORTNIGHT ago, after the "dailies" had published, in accordance with Stock Exchange regulations, financial and other information about the newest amalgamation scheme—Associated Gas and Water Undertakings, Ltd.—we made certain comments in these columns. Horsham shares, only recently acquired by East Surrey, were being handed on to the new concern, and we anticipated surprise in the Industry at the introduction of far away little Kirton-in-Lindsey into the scheme of things. We had, however, the recent assurance of the East Surrey Chairman, which we quoted, that the methods of amalgamation commonly in vogue were being carefully weighed up by the Board, and his opinion that some modification of them might be considered advisable if and when the Company thought fit to extend its already very successful operations.

We are glad now to be able to take up the subject again, and both in fairness to those responsible, and as a matter of considerable interest to the Industry, to give details of the "A.G.W.U.L." scheme. It will be seen that in reality, in common with all others whose serious occupation is to further the interests of the Gas Industry, we can bestow no less encouragement upon it than would be extended to the East Surrey Company proceeding, by ordinary humdrum methods, to enlarge their area of gas administration.

The facts are as follows. In August, 1933, the East Surrey Company was the first undertaking to take advantage of the Gas Undertakings Act, 1932, in order to secure control of the Horsham Gas Company, Ltd. This acquisition practically exhausted the powers granted under the Act, and the East Surrey Gas Company would have had to persevere through Application, Inquiry, and Board of Trade Order to the increase of capital which would have enabled them to visualize the further "rationalization" of gas in their area. The Directors saw greater freedom and wider scope in "A.G.W.U.L."; the latter was formed with three Directors and more than 50% of its voting capital from the parent concern; and the passing of Horsham to "A.G.W.U.L." promptly released a substantial block of East Surrey capital for any local requirements.

Now Section 1 of the 1932 Act states that "It shall be lawful for any gas undertaking to lend money on mortgage to, and subscribe for, acquire, hold and dispose of any shares, stock, mortgages, debentures or debenture stock of, any company or local authority who—(*a*) carry on or are about to carry on, in any part of the United Kingdom, any process or operation of the same or substantially the same character as any process or operation which the undertakers are, as such, authorized to carry on. . . ." Thus it became necessary for "A.G.W.U.L." to acquire that status. The *sine qua non*, in the absence of any outright purchase offering in Surrey, was found in Lindsey; and far as Kirton may be from the scene of "A.G.W.U.L.'s" major operations, there is no reason to doubt that consumers there will feel the benefit of the new and powerful organization.

Co-Operation the Keynote

As for policy, Associated Gas and Water Undertakings, Ltd., are seeking to organize as far as possible on mutual and co-operative lines; and among their aims will be to avoid a heavy charge upon the constituent concerns—as a sort of penalty for being "held"—and to keep the control of the constituents among those who have a direct interest in the neighbourhood of supply. Keep the bounds of such a conferedation flexible, and it can reap to the full the benefit of co-operation and co-ordination.

Apart from adequate local representation on the Board of the central concern, the controlled Companies are to have the opportunity of investing in "A.G.W.U.L." up to the limit imposed by the 1932 Act, so that a proportion of the central profit will find its way back to the makers.

Finances

THE authorized capital of "A.G.W.U.L." has recently been increased to £200,000, divided into 100,000 £1 4½% Cumulative Preference Shares (redeemable 1974-84) and 100,000 £1 Ordinary Shares. The Preference Shares carry no vote. So far £40,000 has been issued, equally divided into preference and ordinary; and the money has been spent in acquiring 75·6% of the total voting capital of the Horsham Company, together with the going concern at Kirton, and leaving a surplus for developing the latter and for working capital generally. The preference shares were disposed of through the Stock Exchange—many were placed within the Industry. Of the ordinary shares, Horsham have come in up to 5% of their authorized capital, and hold 3,059; East Surrey

have 10,001; and the remaining 6,940 have been taken up by friends of the Directors and so of gas. We understand, too, that the Directors are taking steps to see that, if and when further capital be raised, large blocks of shares shall not be allotted and so introduce the risk of outside control.

As matters stand at present, excluding any profits made from the Kirton Undertaking, the dividends accruing from "A.G.W.U.L.'s" investment in Horsham will be £2,008 per annum. Of this the Preference Capital will absorb £900, leaving £1,108 for payment of any operating expenses and dividend upon the £20,000 of issued ordinary shares.

Great Expectations

"A.G.W.U.L.," then, being so closely allied in personnel and traditions to the East Surrey Gas Company, Horsham can look forward to continuing development, and other neighbouring undertakings will be considering how far their consumers and shareholders might benefit from the co-operation and protection offered by the scheme. The East Surrey Company certainly has a record which should make it welcome as a "parent." Itself an amalgamation of four undertakings—Redhill, Reigate, Godstone, and Dorking—its output of gas to-day is 4½ times that of 1920; and its statutory area covers 120 square miles. Its control of the Horsham Undertaking has lasted only a few months; with what effect? Since January 1 last there has been a general reduction in the price of gas of 1d. a therm, and further reductions, up to 1½d., on a block system. For power purposes there has been a reduction of 33⅓%. During the six months to June 30, meters in use increased by 250 (approximately 9%), and as many gas consuming appliances were disposed of in the first three months of the year as during the whole of 1933.

We shall await with keen interest further news of "A.G.W.U.L."

Competition in Ireland

THE Presidential Address of Mr. J. L. Hyslop, of Belfast, delivered yesterday to the Irish Association of Gas Managers, and which will be found on later pages, gives an excellent picture of the type of competition from electricity which the Irish Gas Industry has to face. The whole position is summed-up admirably by Mr. Hyslop, who offers constructive thought on how to meet it. The question as it applies to the south and to the north presents quite different aspects. In the Free State, as is pointed out, the performance of the Shannon Scheme appears to have "justified the expectations of the technicians and the fears of the economists alike." The Electricity Supply Board, having already incurred capital expenditure to supply about 82,000 consumers, requires another million for development. As yet no provision has been made for repayment of capital or for depreciation, and it is likely that the price of current, already high, will have to be raised before the scheme can be established on a self-supporting basis. As in cost, so in reliability, there is simply no comparison between gas and electricity. In February of last year, for example, a snowstorm caused sufficient damage to isolate Dublin from its main source of supply for three days, and the emergency station could cope with only part of its requirements. Other districts were affected for a longer period.

In Northern Ireland the Electricity Board purchases the bulk of its supplies from the Belfast Corporation; and, relieved of the necessity of meeting interest and capital repayment charges on its extensive transmission station, is supplying current at a low cost. "The policy," says Mr. Hyslop, "is one with which we could have little fault to find were there reason to believe that the rates could be maintained at the present level. . . . The responsibility for its inception lies with the Government, which has guaranteed loans and interest. . . ." The whole point is that State-aided competition in the country districts is totally unfair to the Gas Industry, and is likely to place electricity supply in such a financial position that assistance from public funds will be necessary.

Could the B.C.G.A. Help?

To meet this competition every undertaking must do everything to perfect its service, and must also adopt modern selling methods. It is a fact that a large proportion of the public is unaware of the services which gas can offer to-day, and so economically. Countless instances have been reported where consumers, beguiled into installing electricity, have quickly realized that they were paying dearly for a less satisfactory service, and have shown their good sense by reverting to gas. Mr. Hyslop records the stimulating fact that in Cork, the home of one of the emergency electric stations, no fewer than 3,000 gas lighting burners were installed during the past year. The business is there, and modern methods can secure it. One of these methods, as Mr. Hyslop rightly points out, is the multiple-part tariff. A low commodity charge has undoubtedly a wonderful appeal. Another method is keen and well-informed salesmanship. The small undertaking cannot afford to employ a full-time properly qualified salesman. On the other hand it cannot afford to do without qualified salesmanship; and it is here that Mr. Hyslop makes a useful suggestion. He believes that the British Commercial Gas Association ought to have a number of skilled salesmen available for periodic visits to small concerns. This, of course, costs money, but there is a good deal to be said for the idea. Small undertakings in a suitable area might to advantage get together to see what each can subscribe to a common salesmanship fund, and we have no doubt that the B.C.G.A. would do all possible to advance the scheme.

Wet Purification—A Further Process

THE proposed wet process for the removal of hydrogen sulphide from coke oven gas described in a recent paper by Mr. F. Frank Smith and Mr. D. R. Pryde breaks some new ground and provides yet another potential alternative to oxide purification. The paper was reprinted in the "JOURNAL" last week, and merits careful, if critical, examination.

The method proposed, which has been named the "Auto" process, has been used on a small scale to purify the gas supply to canteens and laboratories at the Billingham Works of Imperial Chemical Industries, the gas treated being some 2,500 c.ft. per hour of crude coke oven gas taken from a point before the ammonia scrubbers. The apparatus, which represents a stage of development mid-way between a laboratory trial and full-scale works operation, comprises a scrubbing unit of 6-in. internal diameter, and 34 ft. high, down which

a stream of liquor flows via a packing of open metal grids.

The gas rising counter-current to the liquor is denuded of 60% of its ammoniacal content and of practically all the hydrogen cyanide and hydrogen sulphide. The addition of 20 lbs. of " make-up " ferrous sulphate per day ensures the production of the necessary quantity of iron ferrocyanide which, held in suspension, is the important factor, by virtue of alternate reduction and subsequent oxidation, in the absorption of hydrogen sulphide and the recovery of sulphur. Details of the interesting series of reactions need not be given here. It suffices to remark that regeneration of the liquor, as in the case of the Seaboard process, is by means of air blowing. In the unit cited 250 c.ft. of air per hour at 32 lbs. per sq. in. pressure are mixed " co-current " with the ascending stream of liquor in a regenerating tower 12 in. in diameter and 60 ft. high, at the top of which is situated the necessary sulphur decantation and filtration apparatus. The great difference from the Seaboard process lies in the fact that instead of hydrogen sulphide, ammonia fumes are discharged to atmosphere with the excess air, and so lost; while sulphur is recovered as a fine sludge.

Advantages

The authors claim that the capital cost of plant to operate this process on a works scale would be less than that of oxide purifiers for similar duty, and that the ground space required would also be much less. These two points are only likely to be of special interest to those laying out new works, but it must be conceded that the area taken up by the existing type of oxide purifier installation is disproportionate to its function in the scheme of gas manufacture. Superimposition of oxide boxes with a view to ground economy has been tried, but presents constructional difficulties owing to the heavy weight which has to be supported. This remedy is as yet of limited application, while the Raffloer method, in which it was proposed to pass the gas through a continuous shower of oxide, does not appear to have fulfilled initial expectations.

What may prove a useful claim of the new process is that it would throw a lower back pressure than oxide box purifiers. This remains to be established for full-sized plant, as the evidence adduced in the paper showed that the small-scale unit was somewhat sensitive to overloading. The sulphur in suspension caused foaming in the absorption tower, and the back pressure thrown as a result varied in direct proportion to the hydrogen sulphide content of the inlet gas. Thus at a gas rate of 2,100 c.ft., and liquor flow of 1,000 gallons per hour, the back pressure was 5·0 in. W.G. when the hydrogen sulphide was 200 parts per 10^5 (194 grains per c.ft.) and 15·6 in. W.G. when it was 760 parts per 10^5 (507 grains per 100 c.ft.).

Any method of purification used at a gas-works must be 100% efficient, and it is noteworthy that the authors do not claim an assured freedom from hydrogen sulphide in the outlet washer gas, while they recommend some form of additional treatment, such as a further seal of regenerated liquor through which the gas should be made to bubble. Owing to choking of the tower by accumulated sulphur it was found necessary to change over to an alternative tower every two or three days for cleaning. These minor difficulties might be effectively countered in a larger unit, and it would be unwise to condemn the process on such account before it has been tried on a larger scale. Considerable ingenuity has been shown in the method of continuous sulphur flotation and collection which has been in successful operation for a year, and in other respects, for example, the provision for maximum aeration contact time together with minimum expenditure of air, thought has clearly been expended on the process. As it now stands, the method is one which could be very conveniently installed on a small scale at any coke oven plant on the gas stream supplying the laboratory, which is often totally lacking in provision for purification.

The Ammonia Aspect

The employment of any purification process which depends on the use of an ammoniacal liquor and operates on cold crude gas limits the choice of type for the whole recovery plant. For example, the direct and semi-direct recovery processes so commonly used at coking installations would be ruled out of court, and the economy and lower capital cost of plant for such processes would be unobtainable. The falling market price of ammonia in recent years has brightened the prospects of liquid purification, but caution is advised before embarking on it. There was surely a low limit below which the price of sulphate of ammonia could not remain for long. The tide appears to have turned, but only after numbers of bye-product sulphate producers have either discontinued ammonia recovery or have gone over to concentrated liquor production. The price of sulphate has shown an upward tendency at last, and it is doubtful if the very low figures of a year or two ago will be touched again. It has always seemed an anachronism that ammonia yielded so simply as a bye-product of carbonization should be unable to compete in a market with the synthetic product won at the expenditure of energy in costly plant, and still more of an anachronism that, having obtained bye-product ammonia in the form of liquor, its disposal as an effluent should have had to be considered by some undertakings.

The " Auto " process sacrifices 60% of the ammonia. An ideal process would recover both sulphur and ammonia, and since there is in general more than sufficient sulphur to provide sulphate radicle for all the ammonia yielded from carbonization, it is desirable that some method, such as that of Feld, Burkheiser, or Cobb, should be perfected so as to enable sulphate to be made with greater profit. It may now be that the trouble which tended to stultify many of the ingenious systems proposed for liquid purification and joint sulphur and ammonia recovery—namely, contamination of the reactants with tar or " gum " from the gas—can be effectually countered by the adoption of electrostatic " defogging " apparatus and gum prevention measures. If this is true, it is time that such processes were given fresh works trials under the improved conditions now possible.

The Gas Unit

In our correspondence columns to-day we publish a letter from Mr. C. F. Botley, of Hastings, in which he regrets our advocacy of a small gas unit of 3,412 B.Th.U. rather than one of 4,000 B.Th.U. He maintains that our advocacy is likely to add to confusion. Let it be said at once that we have no desire whatever to add to confusion. We do feel that the small unit of 3,412 B.Th.U. is in the long run far less likely to lead to confusion than the purely arbitrary one of 4,000 B.Th.U. Mr. Botley points out that the 4,000 unit is one twenty-fifth of the therm, and he regards this as rational. But when the sole purpose of the unit is to aid the salesman in competition with electricity, and bearing in mind the psychology of the consumer, it

seems to us illogical and unfortunate that the comparison should not be direct. Mr. Botley also observes in his letter that it is one thing to say that the equivalent of the Board of Trade unit of electricity is 3,412 B.Th.U. and another to adopt a similar unit in gas, which is returned as gross and not net, for comparable purposes. We have yet to be convinced that gross or net calorific values enter seriously into the question. Gas is sold on its gross value. The customer pays for a gross therm, not a net therm; and there seems no reason why 3,412 B.Th.U. should not be on the gross basis. Nor do we think it essential to take into account, in arriving at a "unit," the efficiencies in use of various appliances. As things stand at present the National Gas Council has not given a definite recommendation for or against the adoption of a small unit. What they have said is that if individual undertakings think that a gas unit would help then they should go ahead with it and adopt a unit of 4,000 B.Th.U. We suggest that, before a definite recommendation is given, the claims of the 3,412 unit might well be re-considered.

A Turbine Breaks Down

NEITHER the electricians nor the general public can feel too happy about the Joint Report of the Engineers of the Central Electricity Board and the London Power Company as to the circumstances attending the widespread failure of electricity supply in south east and east London on July 29. The report, which was published in *The Times* last Thursday, is as follows:—

> The investigations have disclosed that the trouble did not originate at the Battersea Power Station of the London Power Company, although it is true that that station became involved in it. Every avenue towards elucidating the general failure having been fully explored, the complete inability to discover any other primary cause for the trouble has forced the engineers to the deduction that the general failure originated with the breakdown of one of the turbines at the Deptford West station of the London Power Company—a deduction which fully explains the subsequent trouble and how Battersea Power Station became involved in it.

The fact that a mishap to a single turbine can result in such inconvenience is certainly cause for reflection. Discussing the breakdown of the grid and several other breakdowns which occurred during the first week in August, the *Electrical Review* said: "Whatever the outcome may be, the disquieting point about supply disturbances is not the simplicity of the cause so much as the fact that a functional local manœuvre may develop into a complication with widespread detrimental consequences."

The reliability of gas will come to be more and more appreciated.

Illumination and Safety

STATISTICS linking up illumination and safety are not numerous, but it seems fair to deduce that the better the lighting the fewer the accidents. Many readers will remember the figures given by Mr. Massey, the Lighting Superintendent at Oldham, in a paper to the Association of Public Lighting Engineers some little time ago. He took a census of the accidents which occurred in Oldham over a period of three years and correlated the results with the public lighting. On the quite legitimate assumption that the number of accidents is proportionate to the traffic risks, he demonstrated by facts that good lighting greatly reduces the traffic risk. Comparing similar distances and equal traffic density of two roads, one in Class D of the B.S.I. Specification and the other in Class F, he found the accident ratio to be 63:100, showing how superior is Class D lighting.

Reference to the matter of safety and illumination has been made in the July issue of the *Illuminating Engineer* and also in the current number. The comments of the *Illuminating Engineer* on the Ministry of Transport's Report on Fatal Road Accidents for 1933 are well worth repeating here. Three main inferences are drawn from the data presented in the report. First, that the tendency to accidents is on the whole always greater by night than by day, which suggests that artificial lighting still falls short of safety demands; secondly, the consequences of this inadequate lighting fall more heavily on pedestrians than drivers; thirdly, during rainy and misty weather this handicap to the pedestrian is still further increased. These inferences are confirmed by a report of the Detroit Police Department recently analyzed in the Transactions of the American Illuminating Engineering Society, and commented on in the August issue of the *Illuminating Engineer*.

In 1931, when full street lighting was in force, fatal accidents occurring by day formed 49%, and fatal accidents occurring by night 51% of the total—*i.e.*, the numbers were approximately equal. In 1932, however, when, as a measure of economy, only 65% of the previous street lighting was provided, 33% of accidents occurred by day and 67% by night—a truly remarkable change. In 1933, when the street lighting was partially restored to 85% of its original value, a tendency to return to the original ratio of accidents was noted, the numbers of accidents occurring by day and by night being respectively 40% and 60%. "These figures," remarks the *Illuminating Engineer*, "certainly seem to afford striking evidence of the relation between public lighting to traffic accidents occurring by night. It would be interesting, however, to have confirmatory evidence from towns in this country where experiments with diminished street lighting have been made." Perhaps some of our readers could help in providing such information.

Forthcoming Engagements.

Sept. 1-4.—SECOND INTERNATIONAL GAS CONFERENCE, Zurich.
Sept. 6.—NORTH BRITISH ASSOCIATION OF GAS MANAGERS.—Annual Meeting in Inverness.
Sept. 7.—SOUTHERN ASSOCIATION (WESTERN DISTRICT).—Commercial Meeting at Dartmouth, 2.30 p.m.
Sept. 11.—I.G.E.—Finance Sub-Committee, 9.45 a.m.; Membership Sub-Committee, 10.30 a.m.; General Purposes Committee, 11.15 a.m.; Gas Education Executive Committee, 4 p.m.
Sept. 17-20.—ASSOCIATION OF PUBLIC LIGHTING ENGINEERS.—Eleventh Annual Meeting at Aberdeen.
Sept. 20.—I.G.E.—Refractory Materials Joint Sub-Committee (Stoke-on-Trent), 2.30 p.m.
Sept. 20.—WALES AND MONMOUTHSHIRE ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—General Meeting at Porthcawl.
Sept. 24-26.—B.C.G.A.—Annual General Meeting and Conference at Sheffield.
Sept. 27.—I.G.E.—Liquor Effluents and Ammonia Sub-Committee, 2.30 p.m.
Sept. 28.—I.G.E.—Joint Research Committee, 10.30 a.m.; General Research Committee, 2.30 p.m.

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Page 22.—DONCASTER. D. T. Livesey appointed E. & M. vice R. Watson who retires on Sept. 30.
Page 56. ROYSTON AND BRODSWORTH. J. Pattison appointed G.M., E., and S.

Personal

A NEW GAS LIGHT APPOINTMENT.

Mr. A. E. SYLVESTER has been appointed Comptroller to the Gas Light and Coke Company. Mr. Sylvester is a Chartered Accountant. He was born in Nottingham in 1891, and served his articles in that city. In 1912 he came to London and joined the staff of Messrs. Barton, Mayhew, & Co., the well-known firm of accountants, with whom he has been connected ever since, except for war service with the Sherwood Foresters and the Machine Gun Corps. He was made a partner in 1920, and, as a representative of that firm, has been engaged for more than two years past in carrying out the re-organization of the Company's methods of accounting, store-keeping, &c.

During that period he has obtained a very wide knowledge of the Company's staff and methods, and the Directors, desiring to make his knowledge and experience permanently available for the Company's benefit, have appointed him to the staff.

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A number of new appointments have been made by the Coal Utilization Council. Mr. P. J. HILL has been appointed to the position of Area Combustion Engineer, Northern Branch, with headquarters at Leeds, Mr. W. C. GAMBLE has been appointed Area Combustion Engineer for the South Wales and South-Western Branch, with headquarters in Cardiff, and Mr. F. W. BRICK has been appointed Assistant Area Publicity Manager for the Wales and Midland Branch, with headquarters in Birmingham.

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Mr. J. PATTISON, Engineer and Manager during the past two years to the Royston and Brodsworth Gas Company, has been appointed General Manager, Engineer, and Secretary of the Company.

* * *

Mr. R. SCOTT, of Bangor, Co. Down, has been appointed Assistant Gas Manager at Ballymena, Co. Antrim, out of 29 applicants.

* * *

Mrs. Marion Miller Broadhead, who on Aug. 10 was married very quietly, at Huddersfield Registry Office, to Sir Walter Gilbey, Bart., the well-known sportsman, is the widow of the late Mr. Wilson Broadhead, a Director of Messrs. Robert Dempster & Sons, Ltd., gas constructional engineers, of Elland.

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We are informed by the Secretary of the Institution of Gas Engineers that Mr. and Mrs. CLIFFORD E. PAIGE (Brooklyn), Major ALEXANDER FORWARD and Miss VIRGINIA FORWARD (New York), Mr. and Mrs. REED MORRIS (Kearny), and Mr. HILMAR PAPST (Portland) will represent the American Gas Association at the 2nd International Gas Conference in Zurich from Sept. 1 to 4 next.

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Lt.-Col. K. C. APPLEYARD has been elected a Director of the Koppers Coke Oven Company, Ltd. Col. Appleyard is Managing Director of the Birtley Company, Ltd., and its Associated Companies abroad, a Director of the Société de Foncage de Puits Franco-Belge, and of Mining and Civil Engineering Contractors, Ltd., and is Chairman of the North-East Coast Engineering Employers Association. He is a Justice of the Peace for the County of Durham and Commands the Royal Engineers of the 50th (Northumbrian) Division, T.A.

Obituary

JAMES WILSON AUCHTERLONIE.

His very wide circle of friends will be grieved to learn of the death of Mr. James Wilson Auchterlonie, Engineer and Manager of the Cambridge University and Town Gas Light Company, at a nursing home on Aug. 9. Mr. Auchterlonie, who was born at St. Andrew's, received his education at Madras College there. Later, at St. Andrew's University, he studied Chemistry and Science, receiving his practical training in the manufacture and distribution of gas at the Works of the St. Andrew's Gas Company under the late Mr. Jesse Hall. In 1892, he went to Ireland as Manager of the Mullingar Works, being elected President of the North of Ireland Association of Gas Managers, which is now known as the Irish Association. He returned to England in 1899 as Assistant to Mr. S. Y. Shoubridge, who was then Engineer to the Crystal Palace, now South Suburban, Gas Company. Three years later he was appointed to the position which he held at the time of his death. In 1910, Mr. Auchterlonie was President of the Eastern Counties Gas Managers' Association, while he was President of the Southern Association in 1915.

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The death has taken place of Mr. R. B. BAILIE, Ballynahinch, Co. Down, Chairman of the local Gas Company.

Correspondence

The Gas Unit

SIR,—I am sorry to see your advocacy of a unit of 3,412 B.Th.U., and one would have thought that some of the experiences in Australia would have made our colleagues in that country hesitate before proceeding with the proposal.

There is much that can be said in regard to this, but I will content myself with reminding you that not so long ago when there appeared to be the probability of confusion in the *size* of the small unit, the National Gas Council (through the Gas Charges Committee) and the Institution of Gas Engineers had a meeting, and after a very full discussion it was unanimously resolved that any unit adopted should be the rational one of 4,000 B.Th.U. which, of course, represents the gross and is 1/25 or 0·04 of the standard therm. It is one thing to say that the heat equivalent of a Board of Trade Unit of Electricity is 3,412 B.Th.U. and another to adopt a similar unit in gas (which is returned as gross, not net) for comparable purposes.

Your advocacy, which I regard as unfortunate, is likely to add to the confusion which it was most desirable to avoid.

Yours, &c.,
CHAS. F. BOTLEY,
Engineer and General Manager.

Hastings and St. Leonards Gas Company,
Aug. 9, 1934.

SIR,—I was interested to read in the "GAS JOURNAL" of Aug. 8 that the Australian Gas Industry had decided to adopt the gas unit as a basis of charge, and that the unit would consist of 3,412 B.Th.U.

I am of the opinion that it would be to the advantage of the Gas Industry in this country to adopt a similar unit, and I may add that such has been adopted by the Swansea Gas Light Company, chiefly to assist the Sales Staff in making a quick comparison with the electrical unit, which would not be afforded when making a comparison with a therm, which is, of course, still the legal method of charging for gas in this country.

On our gas bills the equivalent price per gas unit of 3,412 B.Th.U. is tabulated on a variable quarterly consumption, diminishing in accordance with increasing consumptions.

Yours, &c.,
W. H. JOHNS,
Engineer and Manager.

Swansea Gas Light Company,
Aug. 10, 1934.

Management and the Engineer.

Engineers in general and gas engineers in particular will not be surprised to learn that the British Papers to be presented at the Sixth International Congress for Scientific Management, to be held in London from July 15 to 20, 1935, will be sponsored in many cases by engineers, for the complexity of engineering manufactures has for long compelled attention to the technique of management to a greater extent than in other major industries. It is therefore particularly fitting that the British Council, which is organizing the Congress and upon which the Institution of Gas Engineers is represented, should be able to report at its recent meeting that a number of the Congress Meetings will be held at the Halls of the Institution of Civil Engineers and of the Institution of Mechanical Engineers—though the headquarters of the Congress will be at the neighbouring Central Hall, Westminster.

The main topics of engineering interest to be discussed are manufacturing, selling, and training for management.

The attractive social functions in course of arrangement include a Reception by the Government and by the City of London in Guildhall. The full programme will be available in October, 1934. All inquiries should be addressed to the Congress Secretary at 21, Tothill Street, London, S.W. 1.

News In Brief

A Substantial Reduction in the price of gas—by 6d. per 1,000 c.ft.—has just been announced by the Alresford Gas Company, Ltd.

Additional Supplies of Coke Oven Gas from the Grassmoor Company, Ltd., have been contracted for by the Chesterfield Gas Committee.

To Supply Coke Oven Gas in Bulk is one of the provisions of a Special Order application to the Board of Trade by the Pontypool Gas and Water Company.

Despite the Introduction of Electricity into the Burgh, the consumption of gas in Sanquhar for July showed an increase of 20,000 c.ft. compared with the same month last year.

The Sanction of the Ministry of Health has been obtained by the Oldbury Urban District Council to their application to borrow £5,500 for the provision of new gas mains.

In Keen Competition with Electricity, the Halesowen Gas Company have been successful in securing the public lighting contract with the Halesowen Urban District Council for a period of five years.

Portsmouth Gas Company Dividends.—The Directors of this Company have recommended that an interim dividend of 2½% on the 5% maximum stock and of 4% on the consolidated stock (both less income-tax) should be paid in respect of the half-year to June 30, 1934.

North of England Association.—The Autumn Meeting of the North of England Gas Managers' Association will be held on Friday, Oct. 5, when Mr. R. H. Duxbury will deliver his Presidential Address. By kind invitation of Imperial Chemical Industries, a visit will be paid to their works at Billingham.

Various Gas-Works Improvements were decided upon by the Motherwell and Wishaw Town Council at their last meeting. These include the installation of a waste-heat boiler at a cost of £4,815, and also the provision of extra storage and improved workshop accommodation at the works at an estimated cost of £1,000.

A Second Electricity Failure within five days occurred on the Yorkshire coast on Aug. 8. On Saturday, Aug. 4, Scarborough, Bridlington, and Filey were affected for a considerable length of time in the evening. The failure on Aug. 8 was in the early afternoon and of briefer duration, affecting Scarborough and Bridlington chiefly. On Friday, Aug. 3, there was a widespread failure of electricity in the Wharfedale area of the West Riding of Yorkshire.

London was the Rendezvous for the annual outing of employees in various gas undertakings in Ireland owned by Messrs. Anderson Brothers. The parties joined up at Kingstown from Wicklow, Tipperary, Fermoy, Thurles, Longford, Warrenpoint, and Queenstown, and proceeded to London, where they were met by Mr. R. Bruce Anderson (General Manager of the concern), who, with his son, Capt. G. Anderson, and Mr. F. W. Rogers (Chief Accountant), acted as guide to the sights of the City.

Traffic Priority for Gas Emergency Vehicles.—An order has recently been issued in Paris to the effect that, like fire engines and ambulances, the emergency vehicles of the Paris Gas Company, which may be called out to deal with gas escapes in connection with fires and accidents, shall be given a traffic priority over all other vehicles. The new regulation also provides that such vehicles may break the rules with regard to one-way traffic thoroughfares and proceed in cases of urgency in the wrong direction.

Following the Recent Failure of Electricity on Sunday, July 10, the Hinckley Gas Department inserted a very effective advertisement in the local Press. Written across a portion of a newspaper account of the breakdown is the following letter, addressed to the public. It runs: "I am over one hundred years old and I know I am often considered old-fashioned, but I never fail. Always ready to help you, I am, yours faithfully, G. A. Service." Another undertaking, in the London area, also took the opportunity of displaying in its showroom window what appeared from a distance to be simply four large letters—G.R.I.D.—which, upon closer inspection resolved themselves into the clever slogan—"Gas Really Is Dependable."

The Following Posts, as will be seen from our advertisement columns, are vacant, and applications are invited to fill the positions: Cambridge University and Town Gas Light Company, Engineer and Manager, £1,100 per annum to commence. Shanghai Gas Company, Junior Assistant Engineer, £630 per annum. A company in the Midlands, Assistant Mains and Public Lighting Superintendent. Another undertaking requires an Industrial Gas Salesman.

Successful Cookery Demonstrations were recently held at Horncastle, Lincs., by the Horncastle Urban District Council. The cookery lectures were given by Miss H. Crawford-Fox, M.C.A., of the Parkinson Stove Company, Ltd., and the splendid attendance at each of the lectures testified to the interest of local housewives in cooking with modern gas appliances. During the course of the demonstrations, a full meal sufficient for four persons was cooked in a Parkinson "Newpark" cooker, with 300 B.Th.U. Tully Gas for just under 2½d. An attractive range of Parkinson gas cookers was exhibited, and good business resulted.

Glasgow's Reduced Price.—The Glasgow Corporation Gas Committee, at a meeting held on Aug. 10, made a substantial reduction of 4d. per 1,000 c.ft. in the price of gas. The price now stands at 3s. 2d. per 1,000 c.ft. Bailie John Young, Convener, made the statement that he had suggested this reduction of 4d. instead of the former proposed reduction of 2d. because they had been able during the year to convert a deficit of £66,000 into a surplus of £80,000. In the months of June and July, the consumption of gas had been increased to the extent of 50 million c.ft., which was more than the increase for the whole of the last financial year.

At a Meeting of Holders of the 8% prior lien mortgage debenture stock of Low Temperature Carbonisation, Ltd., on July 31, it was decided to reduce the rate of interest to 5% as from July 1, 1934, also to extend the redemption date to July 1, 1953, the Company reserving the right to redeem the stock at 105%, but not before July 1, 1940. A bonus of £6 5s.% by the issue at par of 6% first debenture stock is being paid to holders along with their 8% to date. The Chairman said he thought that the accounts for the year would show a marked improvement on those of last year. The sales of "Coalite" this summer were 25% greater than last year.

Acid Recovery at Gas-Works Sulphate Plant.—The *Chemical Trade Journal* states that a process has been developed at the Frankfort Gas-Works, by means of which over one-fifth of the total requirements of acid for ammonium sulphate manufacture is produced from the waste gases leaving the saturator. These gases, which contain 20 to 30% of H_2S, are burnt with air. The products of combustion, containing 3 to 5% of SO_2, are converted to SO_3 by passing over a vanadium catalyst, maintained at 400° to 450° C. From 91 to 93% is obtained in a simple water or oil-cooled tubular condenser, in the form of sulphuric acid of 90% strength. In this way 1,100 to 1,200 kilogrammes of monohydrate are produced daily.

Report of the Livesey Professor at Leeds.

Prof. J. W. Cobb, C.B.E., B.Sc., F.I.C., Livesey Professor at the University of Leeds, has submitted his report for the session 1932-33 to the Chairman and members of the Livesey Advisory Committee on the work of the Department of Coal Gas and Fuel Industries (with Metallurgy)

The number of students in the Department increased in the session reviewed from 32 to 36. This was due not so much to an increase of new entries as to the stagnation consequent on industrial depression. Industry was not absorbing graduates at the rate of previous years. Senior students wisely continued to work as post-graduate students pending the opportunity for securing employment. Happily, greater industrial activity in the present session has revived the demand for graduates of the Department, and the total number has fallen to a more normal figure of 30.

A certain amount of re-arrangement of the teaching of Metallurgy has been made. In view of the increasing utilization of gas in industrial furnaces for the heat treatment of metals and similar purposes more attention is being given in the curriculum of gas engineers to the study of Metallurgy. The expansion of this market for gas depends not only on the supply of gas at a sufficiently low

price but upon the possession by the staff of a gas company or authority of knowledge which will guarantee that the approach to an industrial heating problem will be made by scientific methods and with understanding.

The coal industry is showing more interest in the technical side of salesmanship and, in the present session, two members of the staff of a firm of coal factors have been enrolled for lectures and laboratory courses.

Students.

The analysis of the number of students in the Department may be stated thus:

—	1931-32.	1932-33.	1933-34.
1st year B.Sc. Course	6	5	6
2nd ,, ,, ,,	11	5	7
3rd and 4th years B Sc. Course	6	18	10
Post graduate degree students	5	5	6
,, ,, diploma ,,	1	1	0
,, ,, research ,,	..	..	1
Diploma students	1	0	0
Industrial research students	1	1	0
Occasional students	1	1	..
	32	36	30

In addition to these students specially attached to the Department, courses in Fuel and Metallurgy are attended by students of Chemistry, Engineering, and Mining, and lectures on Steam Raising by students of Colour Chemistry, Leather Industries, and Textiles.

New Refractories Specification.

An entirely revised edition of the "Standard Specifications for Refractory Materials for Gas-Works" has been published by the Institution of Gas Engineers. The revision, which is of importance, is the work of the Refractory Materials Joint Sub-Committee of the Institution of Gas Engineers, the Society of British Gas Industries, and the British Refractories Research Association.

Copies of the Specifications (Communication No. 94), which should be in the possession of all gas undertakings, can be obtained from the Secretary, the Institution of Gas Engineers, 28, Grosvenor Gardens, London, S.W. 1, price 1s. 6d. each, including postage. Applications should be accompanied by a remittance for the number of copies ordered.

Prize-Winning Carnival Display.

Second prize in the class for decorated trade vehicles was won by the Bishop's Stortford, Harlow, and Epping Gas and Electricity Company for this decorated lorry which took part in the local Hospital Carnival.

Gas Undertakings' Results

Aberfeldy.

A dividend of 7½% has been declared by Aberfeldy Gas Light Company, which has also placed £150 to the reserve fund. The price of gas has this year been reduced by 5d., to 5s. 10d. per 1,000 c.ft.

Airdrie.

The annual report on the working of the Airdrie Corporation Gas Department for the year ended May 15 states that the amount of gas produced was 144,400,000 c.ft., as against 142,361,000 c.ft. last year, an increase of 2,039,000 c.ft. The coal carbonized amounted to 7,775 tons compared with 7,737 tons, an increase of 38 tons on the previous year. In the manufacture of carburetted water gas, 13,141 gallons of oil were used, compared with 14,734 during the previous year, a decrease of 1,593 gallons. The quantity of gas sold was 135,404,900 c.ft., compared with 133,797,500 c.ft. for the preceding year, an increase of 1,607,400 c.ft. Industrial consumption showed an increase of 550,100 c.ft., the amount consumed this year being 7,323,000 c.ft., while last year's consumption was 6,772,900 c.ft. Public lighting accounted for 10,607,500 c.ft., as against 10,045,700 c.ft. for the previous year, an increase of 551,800 c.ft.

Birmingham.

The report of the Gas Committee of the Birmingham Corporation for the year ended March 31, 1934, shows that the total amount of capital authorized remains at the same figure as last year—namely, £5,610,877—of which sum £143,720 still remains to be borrowed. The capital raised during the year for the purpose of the Undertaking amounted to £282,580, making the total borrowed £5,467,157. The actual capital expenditure for the year was £136,224, and the sum of £122,500 was paid off, making the total capital redeemed £2,240,185. The outstanding liability in respect of capital at March 31 last was £3,134,225, as against £2,974,145 twelve months ago. During the year the quantity of gas sold was 14,177,910,800 c.ft., an increase of 241,342,100 c.ft., equivalent to 1·73%. This compares with an increase of 1·72% in the previous twelve months. This additional consumption was principally in connection with the manufacturing load, and took place in the last three months of the financial year. The position is a satisfactory one and indicates that trade is improving, as well as the fact that manufacturers are taking advantage of the reduction which was made in the general scale of gas charges last year, and are using gas more extensively than hitherto. The total charges against revenue account amount to £1,874,787, an increase of £10,037. The net receipts from the sale of gas total £1,755,891, a reduction of £66,649. This reduction was anticipated in view of the general reduction of 2d. per thousand cubic feet which was made in the price of gas as from the June, 1933, reading of the meters. So far as the accounts under review are concerned, the reduction in price has operated for a period of nine months and represents the sum of £97,000. Comparing this latter figure with the actual reduction which has taken place in revenue, the position is a satisfactory one and justifies their action in revising the scale of prices last year. Principally due to the improvement in the value of tar, an increase of £17,808 is recorded in the sale of residual products. The total credits on revenue account amount to £2,256,155, a decrease of £44,617, providing a gross profit of £381,368 to be transferred to net revenue account.

Camborne.

The report of the Directors of the Camborne Gas Company, Ltd., for the year ended June 30, 1934, shows that the demand for gas has been fully maintained during the year and a satisfactory increase is shown by all classes of consumers. The balance standing to the credit of the profit and loss account amounts to £4,647, which the Directors recommend should be appropriated by the payment of £853, as dividends at 5% per annum less income-tax, and by carrying £3,795 forward to the next account.

Stretford.

The annual report of the Stretford and District Gas Board for the year ended March 31, 1934, states that the total quantity of gas made was 4,257,803 therms actual or 3,956,270 therms calculated on basis of declared calorific value of 500 B.Th.U. per cubic foot, and the quantity of gas sold was 3,646,496 therms, an increase of 548,928 therms, or 17·72%, as compared with the previous year ended March, 1933. The increase in the numbers of consumers is 2,147, or 9·44% during the year. The volume of gas sold during the year was 729,287,000 c.ft., as compared with 619,501,900 c.ft. during the previous year. Receipts for benzole, including naphtha, were £6,262. Total receipts for residuals and benzole are equivalent to 2·53d. per therm of gas sold compared with 2·38d. per therm last year. The coke and breeze sold was 36,153 tons, equivalent to 12·10 cwt. per ton of coal carbonized, compared with 12·24 cwt. per ton in the previous year. The cost of distribution was £43,708, as compared with £44,836 last year. The total income on revenue account is £190,032, and the total expenditure on revenue account amounts to £126,709. The net result shows a gross balance on revenue account of £63,323, compared with £48,601 in 1933, an increase of £14,722. The interest and sinking fund charges, after deduction of contribution of £2,174 from unemployment grants committee towards loan interest charges, amounted to £37,918, leaving a credit balance on the net revenue account for the year of £25,404. To this amount is added the credit balance standing in the appropriation account at March 31, 1933, making the total balance in the appropriation account at March 31, 1934, £48,221.

French Gas Industry

Review of the 57th Congress of the Union Syndicale de l'Industrie du Gaz en France

(*Continued from p.* 309.)

Fire-Fighting in Gas-Works.

An important paper on the protection of gas-works from fire hazards was presented by J. Marcou. He pointed out that the adoption of benzole recovery has increased the number of fire risks to which a gas-works is subjected.

Brief consideration was given to the spontaneous combustion of stock coal, the firing of coke due to faulty quenching, fires due to gas escapes, and fires in the purifier house. The protection of benzole plant and electrical plant was then fully discussed. An outline of the advantages and disadvantages of the various fire extinguishing media was given and safety precautions were fully described. The author favours portable hand-operated and fixed automatic chemical foam equipment for benzole fires. For electrical plant fires, portable and fixed methyl bromide equipment reinforced by carbonic acid gas in cylinders or chemical foam plant is recommended.

Deterioration of Rubber Gaskets.

In the Tourcoing distribution system, according to R. Forrières, no leaks due to failure of the rubber gaskets had been experienced up to 1930, even though some of the mains had been laid down as long ago as 1875.

In December, 1929, a naphthalene scrubber was installed and, after less than a year, leaks in the distribution system commenced to be evident in a small proportion of the joints. It is regarded as likely that it was not the partial debenzolization of the gas which was responsible for the leaks but that the weak points previously covered with naphthalene were now uncovered. During more than 40 years, not only was benzole not removed from the gas, but benzole was added with a view to increasing the illuminating power. Hence the gaskets had ample opportunity of becoming saturated with benzole. The fact that, when leakage commenced, so few of the joints were affected rendered it evident that some agents other than benzole must have provoked local corrosion, and that, too, in just those spots where these agents could find some possibility of exerting their harmful action due to some peculiarity in the nature of the rubber or due to a series of secondary conditions.

For this reason, it was decided to investigate the conditions under which the particular variety of rubber employed would suffer deterioration.

It was found that rubber becomes oxidized in moist air, some carbon dioxide being formed. Oxidation is assisted by ammonia gas and is retarded by benzole vapour. It is believed that the attack of rubber by oxygen in presence of moisture and ammonia is accompanied by formation of a gaseous hydrocarbon. In complete absence of carbon dioxide, rubber is not oxidized by air, whether moisture vapour is present or not.

Ammonium carbonate favours the oxidation of rubber just as much as does the corresponding amount of ammonia, whereas, when a little carbon dioxide is added to air, oxidation is but slightly more rapid than in air alone. High proportions of carbon dioxide in air seem, however, to retard oxidation.

Mineral oils favour the oxidation of rubber. Aqueous ammonia extracts some of the free sulphur from rubber.

The above results were obtained with the rubber normally employed. It is dark brown in colour, internally, and contains 23·6% of ash. Further tests were carried out with a white rubber having an ash content of 54·6%. This rubber is sufficiently elastic when new but does not keep so well on storage. It was found that the white rubber withstood moist ammoniacal coal gas better than did the brown rubber; hence, for use in a coal-gas atmosphere, a rubber with a high ash content seems desirable.

A further fact was established—namely, that tar oils strongly attack and dissolve rubber. This action is assisted by benzole. The viscous rubber in the gaskets of old mains contains tar oils.

The conclusions are, of course, confined to the particular type of rubber investigated. Whereas benzole protects rubber from the combined action of oxygen, moisture, and ammonia by maintaining it in a swollen and plastic condition, it also helps the fixation of tar oils by the rubber and their penetration into the rubber.

At Tourcoing, no joints in bad condition were found in the outlying districts. Wherever worn joints were found, condensates were also present—*e.g.*, near syphons. This seems to confirm the bad effects of excessive humidity in presence of oxygen. The aqueous condensates were accompanied by oil condensates; hence it appears that the condensation of droplets of water promotes the deposition of oil vapour. The obvious remedy is to cool the gas more thoroughly at the works so that less condensation will occur in the mains. Alternatively, it appears that the remedy may lie in the use of a rubber rich in fillers.

Apparatus for the Tracing of Gas Leaks.

A. Schauffler described a portable apparatus for the tracing of gas leaks in the district. It is based on the palladium reaction shown by carbon monoxide. The apparatus is mounted on a trolley, the weight being 55 lbs.

A series of four glass tubes (length 3 in., bore 0·6 in.) is connected in parallel to two manifolds by way of rubber stoppers and cocks. Freshly prepared palladium paper is placed in the tubes. One manifold is connected by rubber tubing to the sampling rod. The other manifold leads by way of a controllable valve and a by-pass valve to a bubbling bottle and an aspirator. The aspirator consists of a tilting box divided into two inter-connected compartments half filled with water. By means of mercury valves, the flow of water from one compartment to the other in the two alternative tilting positions is controlled. The sampling tube passes through a plate of sheet metal loaded on its upper surface with a weight and having a slab of sponge rubber attached to its lower surface. This slab seals off the sampling hole from the air when a sample is being taken and ensures that only the gas in the sampling hole is aspirated through the apparatus. The by-pass valve is used for rapidly purging the apparatus with air after each test. The controllable valve is a smaller one and is set, once for all, in a fixed position.

Sampling holes 0·8 in. in diameter and 1 ft. long are bored out in the territory over the suspected main by one or two men, and an operator carries out a test at each hole. Aspiration having started, the time required for a grey aureole to appear on the test paper is noted. By use of a table, the gas content of the air in the sampling hole may be ascertained. The table gives the relationship between time of appearance of the aureole and gas concentration for CO contents of 6-8% and 12-15% in the town gas.

It is probable that the hole which gives the quickest indication is the one nearest the leak. This is not necessarily always the case, since soil diffusion may upset matters.

The palladium solution used for impregnating the test papers at each test may be used at temperatures as low as 27° F.; but, for lower temperatures (down to 14° F.), 20% of neutral glycerine or preferably rectified spirit should be added to it.

Town Gas for Conditioning Air of Habitations.

G. Richard advocated the more widespread adoption of air conditioning which is hygienic, adds to comfort, increases the output of factory hands, and benefits the Gas Industry. Air-conditioning involves the filtration, washing, humidification, and heating or cooling of the air. Alternative methods for the accomplishment of each of these stages were discussed, and a description was given of two forms of self-contained air-conditioning units. The "Climatobloc" is of French origin and requires an auxiliary equipment for the final heating of the air with gas or its cooling by means of water or blocks of ice. It is made in a range of sizes suitable for the treatment of 13,000 to 130,000 c.ft. of air per hour with cooling effects of 8,600 to 86,000 B.Th.U./hour and heating effects of 7,200 to 72,000 B.Th.U./hour. The "Hot-Kold" equipment is of American origin. It has a heating capacity of 175,000 B.Th.U./hour, its dimensions being 57 in. high by 55 in. wide by 39 in. deep. Eighteen branches can be taken from its main flue, and it is adequate for a total cubical capacity of 20,000 c.ft. Its operation is automatically controlled throughout.

Finally, the author referred to the fuel economy realized by the use of the Split System in which heating is effected by radiators supplied from a coke-fired boiler and ventilation by separate gas-fired equipment. The heating section is, of course, only employed during the winter months.

(*To be continued.*)

Irish Association of Gas Managers

Presidential Address of Mr. J. L. Hyslop, of Belfast

[Presented at the Forty-Second Annual General Meeting, Belfast, Aug. 14.]

I would like in the first place to express my thanks for the honour you have conferred upon me in electing me your President for the past year—an honour I appreciate the more inasmuch as it is generally reserved for those who have full control of a gas undertaking; and for making acceptance of the honour possible my thanks are due to my Chief, Mr. J. D. Smith, whose help and encouragement during my period of office I gladly acknowledge.

It is now six years since our Association held its Annual Meeting in Belfast, and since that Meeting we have been called upon to fight against a combination of adverse circumstances which must be without parallel in the history of our Industry. Industrial depression, intensified competition, and, for some of our members, taxes on raw materials, have all had to be countered, and it is gratifying to know that, although a few of the smaller undertakings have felt the pressure of events, our Industry as a whole has made steady progress throughout this trying period, and sales of gas in Ireland have shown a continuous increase year by year.

To-day we have a much brighter prospect before us. Industrial conditions are improving, and the first requirement of reviving industry being efficient heating service, we may now look forward with confidence to a period of rapid expansion.

During recent years a fundamental change has been taking place in the outlook and in the mode of living of the community. Greater comfort is being striven for on every hand; labour saving devices for the home are much in demand; and pleasing design and artistic finish have come to be regarded as essentials in domestic appliances. The effect of the changes, so far, has been most pronounced upon our gas supplies, but there is every indication that it will soon extend to our bye-products as well.

Coke for Water Heating.

At the present time the outlook for our principal bye-product, coke, is very hopeful. As a cheap and efficient industrial fuel it still finds great favour, and for central heating and for domestic water heating the demand is growing rapidly. There is no doubt that our customers appreciate its advantages as a smokeless fuel which will provide unlimited supplies of hot water at a very low cost, but it cannot, unfortunately, as yet be said that we have developed its use for these purposes to anything approaching the fullest extent. The load, it is generally recognized, is an ideal one from our point of view on account of its regularity. Low installation and low running costs make development a comparatively easy matter, and yet, too often, the opportunity is neglected.

The reason, I think, can in many cases be found in the fact that this water-heating load is also a most desirable one for gas, and the fear exists that by pushing coke we may deprive ourselves of a valuable outlet for gas. A stage, however, has now been reached where further neglect may well result in our losing a good part of the load altogether, for our electrical friends are already concentrating their efforts upon this particular field. We ourselves are in a position to meet the water-heating demand, either with gas or with coke, at a fraction of the cost of an electrical service, and if our competitors make any headway we shall have only ourselves to blame. The question of policy is one for individual decision. To my mind the most commendable is first to push gas with its somewhat higher fuel cost but high convenience factor, and, failing acceptance, to follow up with coke with its low fuel cost but lesser convenience; and this, it may be added, can only be satisfactorily accomplished by personal contact with the householder.

While the present demand for coke may be considered satisfactory we cannot close our eyes to the fact that the tendency to-day is towards fuel in gaseous form or, rather, fuel on tap. In industry and in the home alike such supplies are being more and more appreciated, and it is being more widely realized that higher fuel cost is amply compensated by greater convenience and controllability. We already have seen our coke partially replaced by gas in bakeries which formerly constituted one of its best markets. We have seen an increasing desire to utilize gas for central heating, and though the tendency has to some extent been retarded by the application of thermostatic control and automatic feed to coke-fired boilers, there can be little doubt that eventually the demand for cleaner and more convenient fuel will win the day.

THE PRESIDENT,

J. L. HYSLOP, of the Belfast Corporation Gas Department.

Born in 1895, Mr. J. L. Hyslop was educated at Ayr Academy. He received his Technical education at the Royal Technical College, Glasgow, and the College of Technology, Manchester, and commenced his engineering career in 1913 as an apprentice with Messrs. A. Barclay, Sons, & Co., Ltd., Kilmarnock. During the war he was on active service for four years in the East and in France with H.M. Forces, and on his return, in 1919, joined the Technical Staff of Messrs. West's Gas Improvement Company, Ltd., Manchester, as a pupil. Subsequently he served the same firm as a Superintending Engineer and carried out several extensive reconstructions of vertical retort installations. While engaged with West's, he had a special course in Gas-Works Chemistry, under Mr. W. Buckley, at the Droylsden Gas-Works of the Manchester Corporation. He took first place in the City and Guilds of London examination in Gas Engineering in 1922, and was awarded the Silver Medal. In 1924, Mr. Hyslop was appointed Technical Assistant at the Belfast Corporation Gas-Works, under Mr. J. D. Smith, and in 1928 received his present appointment as Chief Assistant. He holds the Diploma in Gas Engineering of the Institution of Gas Engineers, of which he is a member.

Complete Gasification Prospects.

The possibility of having to gasify our coal completely in the near future need not, I think, give rise to serious misgivings. Technically we are quite prepared for it. Complete gasification systems, it is true, have not as yet been adopted on a sufficiently large scale to allow of a reliable estimate being made of their possibilities, but they appear to offer scope for development; and meanwhile we have our

water gas plants, noted for reliability and ease of control. For the smaller works an automatic blue water gas plant has been developed, and a description has recently been published in the Technical Press of a complete Gasification Plant for which a yield of 140 therms of 400 B.Th.U. gas is claimed.

Such difficulties as lie in the way of complete gasification are economic, rather than technical, and the question that arises is whether or not it would enable us to sell our gas more cheaply than at present. When we consider that for every 75 therms of gas we sell to-day we have to dispose of approximately 130 therms in the form of coke, we realize, in the first place, that to add only half of this load to our gas demand would in itself reduce production costs substantially. But apart altogether from the economy of increased production, an analysis of our figures at Belfast seems to indicate that with modern water gas plant we could, even under present conditions of supply, gasify the whole of our coke without any great increase in the cost of gas manufacture.

Water gas, we know, appears to cost more to manufacture than coal gas, mainly on account of the cost of oil and of the fact that coke is generally charged to the process at a figure much higher than its real market value; but the manufacturing cost, excluding raw materials, is actually only about half the corresponding cost for coal gas. The advantages incidental to water gas manufacture are so widespread that it is extremely difficult to assess their effect upon ultimate costs, but the credits, it is worthy of note, appear mostly in the coal gas account, where both higher residuals returns and lower carbonizing costs, consequent upon constant operation of plant, are shown. It is an interesting fact that after supplying almost 30% of water gas in Belfast for the past 20 years, and 40% to 50% in the previous 16 years, our charges for gas, ranging from 2s. 2d. to 1s. 6d. per 1,000 net, are still among the lowest in the United Kingdom; and while it is admitted that other circumstances have contributed to this happy position, it is not unreasonable to assume that some of the credit is due to the policy of water gas manufacture.

There is one point which would require consideration in the event of the conversion of coke to water gas becoming general—the use of gas oil for enrichment would have to be restricted, with the twofold object of reducing manufacturing costs and eliminating imported materials. Our own tar products should be capable of development to replace it, to a limited extent, but in the interests of lower costs we might have to consider supplies of gas at a quality nearer 400 B.Th.U. than is now usual.

Tar for Road Purposes.

Regarding our tar it is difficult to generalize, since its value to individual producers in Ireland is dependent largely upon geographic situation. The popularity of prepared tar for road purposes is well maintained, and in spite of severe competition from imported materials the value of the home-produced material is being increasingly recognized. The prominence given to the problem of road accidents of late has focussed attention upon the dangerous, glass-like surface resulting from the use of some foreign products, and a demand has arisen for the treatment of all road surfaces to render them non-skid. It is so widely appreciated by road authorities that refined tar, properly applied with suitable aggregate, is unsurpassed for this purpose that we may confidently look forward to an expanding demand for our product. The British Road Tar Association is carrying out valuable educative and propaganda work on our behalf, but that does not diminish our responsibility as individuals for taking every opportunity to push British tar for British roads, both on account of its intrinsic merit and the labour it absorbs in its manufacture.

Competition.

I now come to what, for us, is the most important of the influences at work to-day—namely, electrical competition. Despite the fact that Ireland, with its scattered population, presents an unfavourable field for large-scale development, our respective Governments have taken the task in hand and have constituted Electricity Boards whose function it is to promote and improve the distribution and sale of electricity throughout the country. These Boards, having spent vast sums upon transmission lines, are now making great efforts to increase their load so as to justify the expenditure and to spread the interest and capital charges, when they become chargeable to revenue, over as large a number of units as possible.

The question as it applies to the south and to the north presents quite different aspects, and I propose to deal with them separately. In the Free State the performance of the Shannon Scheme appears to have justified the expectations of the technicians and the fears of the economists alike. The Electricity Supply Board, having already incurred capital expenditure amounting to ten million pounds to supply, roughly, 82,000 consumers requires another million for development, and it is not surprising that charges for current are now relatively high. The Board was able to show a small balance on last year's working, but as practically no provision has yet been made for repayment of capital or for depreciation, it appears certain that charges will have to be still further raised before the scheme can be established on a self-supporting basis. The present rate of development cannot in itself adjust the balance. It has already slowed down to such an extent that last year's sales, of approximately 120 million units, represent an increase over the previous year's of less than 9%.

Two interesting facts emerge from the last report of the Board. The first, that the abnormally dry summer made water conservation so imperative that the Shannon station had to be closed down for 674 hours and emergency steam stations brought into commission. The second, that a snowstorm in February, 1933, caused extensive damage to the distribution system. Twenty-three steel masts on main transmission lines were broken, and Dublin, isolated from its main source of supply for over three days, had to depend upon an emergency station which could only supply part of its requirements, while other districts were affected for a longer period. The latter fact is of particular interest as showing the extent to which an overhead transmission system is at the mercy of the elements. The failures invariably take place at times when supplies of heat and light are most urgently required, and the plight of the unfortunate owners of all-electric houses is not to be envied.

As already stated, charges for current are high. Even under a two-part tariff, with a heavy annual fixed charge, the commodity charge is 1½d. per unit. Complaints have appeared in the Press that at that price electricity cannot compete with gas, and we agree; but it is doubtful if it is generally realized just how much more economical a gas supply really is. Countless instances have, however, been reported where consumers, beguiled into installing electricity for domestic purposes, have quickly realized that they were paying very dearly for a less satisfactory service, and have shown their good sense by reverting to gas; and it is stimulating to know that in Cork, the home of one of the emergency electric stations, no fewer than 3,000 gas lighting burners were sold during the past year. Facts such as these speak for themselves.

Electricity in the North.

In Northern Ireland the position is somewhat different. Here the Electricity Board, purchasing the bulk of its supplies from the Belfast Corporation Station, has erected an extensive transmission system, and being meantime relieved of the necessity of meeting interest and capital repayment charges out of revenue, is supplying current at flat rates, and under a two-part tariff which consists of a moderate fixed charge and a commodity charge of ¾d. per unit. These rates for country districts compare very favourably with the rates in force in Belfast itself, and in fixing them the main concern appears to have been to strike a level sufficiently low to induce the widespread use of electricity.

The policy is one with which we would have little fault to find were there reason to believe that the rates could be maintained at the present level, but it requires a good deal of optimism, when the enormous capital cost of supplying a sparsely populated district such as this is taken into account, to believe that a supply can be given indefinitely to towns and villages 40 miles distant at a rate the same as, or lower than, is prevalent in Belfast. The scheme is still in the development stage and it is, unfortunately, not possible to produce actual figures to present an overwhelming case. The responsibility for its inception lies with the Government, which has guaranteed loans and interest, and I think it is not too much to ask that it should satisfy itself that the rates are fixed on a basis which is reasonably sound. If they are found to be justified by future prospects we have no complaint to make; but we do at present feel that, in our country districts, we are being subjected to State-aided competition which we believe to be unfair, inasmuch as it seems not unlikely that a continuance of present policy will ultimately place electricity supply in such a financial position that assistance from public funds will be necessary to save it from extinction.

Our Government has always shown a most commendable desire to stimulate and encourage established industries, and it is well to remember that our Gas Industry is one of the most important of established industries in the country to-day. In Northern Ireland alone it supplies annually

nearly 5,500 million c.ft. of gas for heating, for lighting, and for power purposes. In addition to gas, it supplies some millions of gallons of tar for road making, large quantities of disinfectants for various purposes, fertilizers for our farmers, and over 100,000 tons of smokeless fuel which help to maintain the atmosphere of our towns in a clear and healthy condition. All these commodities are produced locally and provide a vast amount of employment, direct and indirect, for all classes of workers; and last, but not least, it makes large contributions to rates and taxes, both for its works and for the mains in the highways through which gas is supplied. Our Industry has always developed without artificial stimulus and does not now require assistance, but it does seem only reasonable to expect that the Government should not make use of its power to favour unduly the development, at our expense, of a competitor whose service is more costly to the consumer, and often less satisfactory.

Meeting Competition.

In the meantime the question we have to decide is how best to meet the competition. We all know that gas, as supplied by most small undertakings, can perform any heating service at a fraction of the cost of electricity, even at the existing rates. Electricity, on the other hand, has the great advantage of novelty, and until experience has shown its limitations as a heating agent we must be prepared for a harder fight to extend our supplies.

The first essential in consolidating our position is to make our service so perfect that there will be no desire for change. To go hand in hand with perfect service we require attractive tariffs to stimulate demand by reducing the cost to the consumer as consumption increases, and in this direction the two-part tariff has much to commend it. Our competitors have found it to be their greatest load-developing asset, and it is safe to say that without it they would make little headway outside the lighting and power fields. The low commodity charge has a wonderful appeal, and, though it does not represent the real cost of the service, the fact remains that when comparisons are being made it is conveniently assumed to do so.

In these competitive times a commodity, however attractive the price, will not sell itself. We know that a vast potential load for gas exists, but if we are to develop it we must go out and win it by creating interest and by showing what we can do. Even in the smallest of towns there are scores of operations which could be carried out with greater convenience or economy with gas if only they could be sought out. The small undertaking, unfortunately, cannot afford to employ a full-time trained salesman, though much might be done by collective effort. It is a matter for regret that the British Commercial Gas Association cannot see its way to have a number of skilled salesmen available for periodic visits to small concerns, but with the demand for properly trained men far exceeding the supply it is easy to appreciate the difficulty. The manager of the small undertaking, pending more satisfactory arrangements, must perforce add salesmanship to a multitude of other duties, and having the advantage of personal contact with his consumers must make the most of it.

To facilitate our selling, gas must be brought within easy reach of everyone. One of the difficulties of getting gas into houses not already equipped is the fear of disturbance in laying a supply, and if other supplies are already available we are at a distinct disadvantage. It is well worth while, when new houses are being constructed, to treat the builder generously in the matter, but if even that should fail it is worth considering doing the work ourselves, trusting to following up to bring it into use. Experience has shown that if gas is on tap it will be used, and where alternative supplies are available gas is almost invariably chosen for cooking and for heating too. But even more important than new construction, and less costly, is the building up of demand of existing consumers. With only a fraction of the water heating and space heating loads as yet satisfied we have plenty of room for expansion, and to speed up development we must be prepared to supply our cookers and heaters in modern finishes, on very attractive hire-purchase terms, or, if necessary, on simple hire.

Educate your Public.

Probably the greatest handicap to our sales efforts is the lack of knowledge on the part of the general public, both about our activities and about the performance of modern gas apparatus. Our competitors have taken full advantage of the fact and have been cultivating the idea in their propaganda that gas is inefficient, that it is out-of-date, and even that it is unhealthy in use. We ourselves are so well aware that gas is none of these that we are inclined to treat such distortion of the facts somewhat lightly, but we must remember that by repetition these mis-statements may be accepted as truth unless we take steps to contradict them. If the magnitude of our industry compared with electricity supply were better appreciated, there would be little inclination to believe that gas was getting out-of-date. In Belfast, for instance, we supply annually in the form of heat in our gas alone almost twelve times the amount of energy supplied by the Electricity Undertaking for private purposes. If we include current supplied to the tramways and the bulk supplies to the Electricity Board, we still supply eight times as much; but when we take into account the heat value of the coke and tar we sell, in addition to our gas, the total amounts to 24 times the electrical private supplies. All these services are provided, moreover, with a capital expenditure of less than two-thirds that of the Electrical Undertaking. While of strictly local application, these figures approximate to the average for the whole country, and they show unmistakably that the electrical industry has a very long way to go before it can claim to render anything like the service to the community that the Gas Industry is doing to-day.

To make known the services we have to offer we have ample resources at our command—advertising, displays of modern appliances, cookery demonstrations, distribution of literature—all these have their part to play; and to back up individual effort we have our British Commercial Gas Association, specializing in these activities, and ready at all times to give expert advice and assistance to its members. To the public we have no lack of interesting information to impart. We can tell of our various types of water heaters in enamel finishes, from the instantaneous heater giving unlimited supplies of hot water at a turn of the tap, to the small storage heater keeping a few gallons of water hot continuously, and cutting down the gas supply automatically so that none is wasted; all working, too, at efficiencies of from 70% to 80%. We can tell of our cookers, unsurpassed for economy and for quick service, with automatic oven control which maintains a pre-determined temperature under any conditions, so that complete dinners may be cooked without attention, at a cost, for a family of four, of about 1d.; and we can tell of our gas fires, in designs and colours to harmonize with any decorative scheme, giving instant heat, and plenty of it, when required.

The cost of these services naturally varies from district to district, but it is always moderate. In our own case it is less than half the cost of an electric service for water heating, for cooking, or for room heating, even when we leave the fixed charge out of account and assume that electricity can be obtained at a net cost of ¾d. per unit, which, of course, it cannot.

Education.

Finally, a word about education. Our Industry in the future will have to be carried on under highly competitive conditions, and if it is to continue to make headway it is essential that the personnel should be highly trained and well qualified technically and commercially. To meet the need, the Institution of Gas Engineers and the British Commercial Gas Association have organized various education schemes which are too well known to require enumeration; but it is very disappointing to find that the number of candidates as yet supplied by Ireland is negligible. It is admitted that facilities for technical education are few and far between, and approved courses, on account of geographical conditions, are out of the question; but if the thirst for knowledge really exists it is not impossible to find ways and means of overcoming these handicaps. It may mean greater sacrifice than elsewhere, it may mean a closer devotion to study; but it is well to remember that if the difficulties to be surmounted are great, the honour of winning through in spite of them is correspondingly greater. The future status of our Industry depends upon the attainments of its individual members, and I appeal to our younger members to take full advantage of such facilities as are available, and to play their part in helping to raise the Gas Industry in Ireland to still higher levels.

As an Industry we have a wonderful future to look forward to. The present developments are bound ultimately to re-act in our favour by stimulating demand for heating service, and we are in an exceptionally strong position to satisfy the demand, both on the grounds of economy and of convenience. We know that success demands constant effort. We know that it demands constant vigilance to keep our whole organization up to concert pitch. But we know that with the right outlook and with the right methods we can meet all competition, and extend the sphere of our operations as never before.

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The Dustproofing of Coke*

A Description of Equipment at the Flushing Coke Station of the New York and Queens Gas Company

By R. L. Coryell, Chemical Department, Consolidated Gas Company of New York

The dustproofing of coke is by no means a new idea to the engineer. This subject has appeared on the programme of many technical meetings during the past few years, and it also has been discussed frequently in the various trade journals.

To-day, however, the subject has assumed greater importance. The public generally recognize the fact that coke is an extremely efficient fuel with certain definite advantages over the other forms of solid fuel. This wide acceptance should serve as a stimulus. The Industry should not be content with the quality of its product, but rather should do all it can to make it even better. There is little doubt that the complete elimination, or even a reduction, of dust would result in better satisfied customers, and hence in a larger number of users.

The " modern basement " idea has also made the dustproofing of coke of more importance than before. There is a vogue for converting cellars into usable space, where people can play, entertain, and develop their hobbies. Obviously, the customer who has a ping-pong room or amateur workshop in his cellar is going to notice the dust of the fuel he is using, and, moreover, he is going to do something about it. If he is using coke, and cannot purchase a dustless coke, he will invariably turn to something else.

This important element of customer satisfaction was a consideration in installing dustproofing equipment at the Flushing Coke Station of the New York and Queens Gas Company (Consolidated Gas Company system). The installation was completed in September, 1933, and all coke sent to customers during the past heating season was dustproof. The treatment, which is effected during the loading of the delivery trucks, consists of the application of a water emulsion of Coalkote " B," produced by the Sun Oil Company.

This product is obtained in concentrated form. It is viscous at ordinary temperatures, and must be emulsified with water at about 200° F. before it is used in the dust-laying treatment. The recommended proportions are one part of concentrate to 15 parts of water.

About 2 gallons of this emulsion are sprayed on each ton of coke as it rolls down the loading chutes at the Flushing Coke Station. During cold weather the same precautions against freezing must be taken as with water lines.

The general layout of the Flushing installation is shown in the diagram accompanying this article.

The concentrated " Coalkote " is received in drums and is heated to a suitable handling temperature of 200° F., by placing them in an insulated box and using immersed steam coils. The heated concentrate is then pumped by hand to Tank 1, where it is again heated by internal coils to more than 200° F. An equal volume of water is added slowly, and the temperature is maintained as near to 200° F. as possible. Care is taken to see that the temperature does not exceed 210° F. The final 15 to 1 mixture is made by adding one part of the 1 to 1 mixture to seven parts of water in either Tank 2 or 3, where a temperature of 100° F. is maintained. Indicating thermometers (marked 2 on the chart) are provided for each of the three tanks.

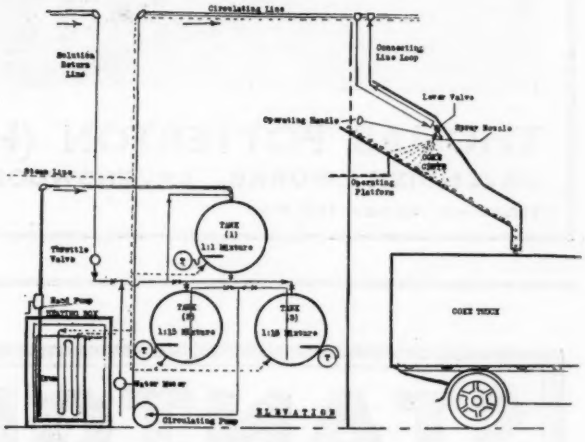
To provide a uniform supply of the emulsion at all chutes, an electrically driven gear pump operates on a circulating line at a pressure of 60 lbs. per sq. in. This pressure is maintained in the line by a suitable throttle valve.

The feed to the spray nozzles is controlled by a lever valve, the handle of which is attached to a ¼-in. iron rod which extends to a point near the lever operating the coke bin shut-off gate. Thus, the operator can start or stop the spray as he controls the loading of the truck. A circulating loop at each chute ensures sufficient heat at the valve during severe weather. As an added precaution, this valve is placed within 6 in. of the spray nozzle.

The rate of spraying depends on: (1) Size of spray nozzle, (2) loading rate, and (3) concentration, pressure, and temperature of the liquid. The loading rate should be adjusted so that the stream of coke will not be too " thin " over the chute where spraying is effected. It is not necessary to have a 1 to 15 concentration of the liquid, since some stations use a concentration as high as 1 to 10. Regulation of the pressure may be effected at the pump by various means. The temperature can be maintained anywhere from 60° F. to more than 120° F.; in general, 100° F. appears to be most suitable for conditions at the Flushing Station. After these factors have been considered, the size of the spray nozzle may be determined. A 3½-mm. hollow-cone nozzle (atomizing type) giving a flow of 2·5 to 3 gallons per minute is used at Flushing.

One spray nozzle is used on each chute and is placed so as to cover the width of the chute. If practical, more than one spray per chute is recommended. Each nozzle is enclosed in an electrically heated box, heat being applied only when there is freezing weather.

It has been found desirable to remove and clean the spray nozzles about once a month as a gummy material may slowly accumulate in the nozzle, thereby decreasing the coverage and the effectiveness of the treatment. At regular intervals the spray rate is checked and the effectiveness of the dust-laying treatment determined by the box test.[1]



Lay-Out of Apparatus for Treatment of Coke to Prevent Dusting.

The material used at Flushing was described briefly in the paper presented by Mr. H. J. Meredith, of the Koppers Gas and Coke Company, of Kearny, N.J., at the recent Joint Committee Conference of the Production and Chemical Committees of the American Gas Association, May 21 and 22. The following quotation is from Mr. Meredith's paper [which was published in the " JOURNAL " for Aug. 8.]

Oil " B."

Cost f.o.b. producers' works—10 cents per gallon in tank cars.

Quantity added: 2 gallons of emulsion (containing 6·25% oil " B ") per ton of coke.

This is a petroleum product and has been quite extensively used in the coke industry. It is a black heavy concentrate, semi-solid at 60° F., and shipped either in drums or tank cars. Preparation for use is effected by heating it to 180°-200° F. with direct steam, and adding an equal volume of water slowly, accompanied by agitation with the steam. This 1:1 emulsion, if properly made, will have a dark brown colour, and is stable at temperatures above 40° F. It is further diluted as required so that the final emulsion has a water to oil ratio of 15:1. If the producer's instructions are carefully followed, a very satisfactory emulsion can be made.

It is commendable on account of its cheapness. It allays considerable dust, and producers who have used it have noticed an improvement in their product quite commensurate with the cost. Companies that pride themselves

* From the *Gas Age-Record*, June 23, 1934.

[1] A. R. Powell and C. C. Russell, *Ind. and Eng. Chem.*, Analytical Edition, Vol. V., pp. 340-341 (1933).

"Empire," "Emperor," & "Rex"
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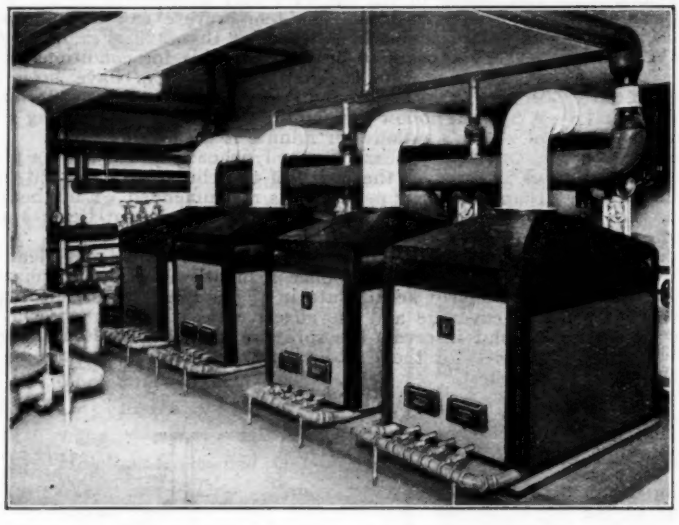

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These pipes have a carrying capacity 20% greater than that of ordinary 3in. diameter cast-iron pipe or steel tube, whilst the spun metal gives greater elasticity and a higher factor of safety.

SPECIFICATION

Actual Bore	3·28 ins.
Thickness	0·25 ins.
Length (effective)	4 yards
Weight	1 cwt.
Coating	Coated both sides, outside only, or uncoated

The external diameter of the pipe and the internal diameter of the socket are to British Standard specification. **All these pipes are hydraulically tested to a pressure of 200 lbs. per square inch.**

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on the appearance of their truck bodies, however, complain that the drippage from the loading chutes leaves black oily smudges on them and offer this complaint as a real menace to its popularity.

It is, of course, non-corrosive and odourless. All pipelines conveying it should be well insulated and where possible accompanied by companion steam lines, for if the emulsion breaks in the lines it causes stoppage of sprays and a general nuisance all through the system.

The trouble resulting from drippage from loading chutes referred to by Mr. Meredith has been corrected at the Flushing Coke Station by a slight modification of the chutes.

Radiant Heat and Comfort

By Harold Hartley, D.Sc., Head of the Research Department, Radiation Limited.

[A paper before the Institute of Fuel.]

In this country it is necessary, for the greater part of the year, to provide in the home an artificial source of warmth to enable comfort to be attained. The temperature at the surface of the body, although somewhat below that of blood heat, is considerably higher than that of the air in our rooms or of the walls of the rooms. A person at rest or in a sedentary occupation loses about 450 B.Th.U. per hour; of this, some 43% is dissipated by radiation, 30% by convection, and 20% by water evaporation, the remaining energy being used in the warming of inspired air and food, and in the performance of work.

The loss of heat from the body can be reduced by raising the temperature of the air. This can be done to such an extent that it is no longer necessary for comfort to provide any additional source of heat.

There are, however, objections to such a means of attaining comfort, principally owing to the fact that our bodies are very sensitive to changes in the air temperature when the interchange of heat is effected only by convection. In addition, as the air has to be breathed, the possible effect of the heated air on the respiratory passages has to be borne in mind. Determinations have been made of the temperature conditions required to ensure comfort in a stagnant or an almost stagnant atmosphere. It will be realized that the temperature conditions which apply for still air may not produce the desired result if there is considerable air movement. As some 20% of the total heat loss is represented by the latent heat of evaporation of water vapour given off from the body, it is to be expected that the humidity of the atmosphere may also influence the sensations experienced. Some work has been published in the United States on the effect of change of humidity on the air temperature requisite for comfort, but it does not seem possible, however, to state definitely what is the precise effect of a given change in the humidity of the atmosphere, or even of a given change in the partial pressure of the water vapour present. In general it can be said that if the air of a room is somewhat hotter than is required for comfort, then increase in the humidity will make the conditions still less comfortable. On the other hand, if the air is too cool for comfort, increase in humidity will tend to increase the degree of comfort. In each case, of course, decrease in humidity would have a converse effect.

Fishenden and Willgress* have shown that with air at 65° F. and the surrounding walls at the same temperature, comfort is attained by a person at rest in the absence of any additional source of radiation. A relatively small change in air temperature, however, upsets the equilibrium condition necessary for comfort. For example, the same authors state that if the temperature of the environment was at 62° F. and there was no additional radiation, the room was found too chilly for continued quiescence, whilst at 68° F. it had become slightly too warm. Further, if the walls are slightly cooler than the air, the latter must be at a temperature above 65° F. to satisfy the requirements of sedentary workers; an air temperature of 66° F. being necessary in conjunction with solid surroundings at 63° F. or an air temperature of 67° F. with the walls at 61° F. They make the interesting observation: "When the walls and floor were more than a degree or two colder than the air, however, very undesirable conditions prevailed, and chilliness combined with stuffiness was felt when the air temperature was slightly too low for warmth." When the temperature of the walls is a few degrees in excess of the air temperature, however, comfortable conditions are produced.

If there is available a source of high-temperature radiant energy, comfort can be attained with much cooler air. The additional radiant energy necessary is determined by the difference between the temperature of the cooler air and 65° F. For example, the same authors found that with air at 60° F. a mean horizontal component of radiant energy of about 30 B.Th.U. per sq. ft. per hour produced warmth, whilst at 55° F. 75 B.Th.U. per sq. ft. per hour, and at 50° F. 120 B.Th.U. per sq. ft. per hour were required. With air at 45° F. there was required 170 B.Th.U. per sq. ft. per hour in the form of radiant energy. With air temperatures below 45° F. it was found impossible to get comfortable between the extremes of intense cold and scorching radiation. They concluded that the most comfortable conditions corresponded with an air temperature of about 55° F. in conjunction with the requisite intensity of radiation for warmth.

Fishenden and Willgress used sources of high-temperature radiation—a gas fire and an electric radiator respectively—in their tests referred to above. These authors, however, also carried out a number of experiments with special low-temperature radiators at a temperature of approximately 750° F., and found the same aggregate intensities of radiation were required as from the high-temperature sources. In fact, they commented that owing to the more uniform distribution of the radiation with height, the degree of comfort was higher than with either of the other two radiators. The intensity of the radiant heat with which Dr. Fishenden and Mr. Willgress were concerned, however, is so much below the intensity which can be endured that it is unlikely any material difference would be detected between the conditions produced by radiant heat of different qualities.

The point to be emphasized is that if there is available an additional source of radiant energy in a living room, comfort is attained with a cooler atmosphere and the conditions are found to be much more stimulating. This is, in part, a consequence of the effect of the cooler air on the respiratory organs. With cold air the mucous membrane of the respiratory passages contracts and there is an increased flow of lymph to the surface, whereas if the air is hot the membrane expands and the conditions set up are much more favourable for the development of the germs of colds and other ailments.

It has been mentioned already that it may not be possible to attain comfort even with radiant heat irrespective of the air temperature. The air even in the English climate can be too cool to permit of comfort being attained with the aid of a radiant fire. Whilst the effect may to some extent be accentuated by movement of the air, the movement in living rooms is generally so slow that it is the temperature of the room itself which is the determining factor. It must be remembered that radiant heat falls only on those portions of the body which can "see" the source. Thus, the face, shins, feet and hands may be warmed, while the calves, back of the arms and the neck are not receiving directly a supply of heat. Often when seated in an armchair in front of a fire, if the air temperature is too low, it will be found that the shoulders or the arms which project beyond the sides of the chair feel cold, and even the hands themselves may become uncomfortable if the occupant of the chair is reading a book.

With such modern types of heating appliance as permit of rapid and controlled variation in the output of radiant heat, it is, however, more easy to attain comfort than when there is dependence solely upon a source giving off convected heat. The rate of input of heat to the body can be increased, and although the energy may be absorbed on one side only of a limb, it will be found that the temperature of the reverse side is raised, just as when the hands are immersed in hot water the temperature is raised in other parts of the skin. (The point can easily be tested by holding the hand in front of the fire—the result is no doubt due to blood circulation.) With a high-temperature source of radiant energy available, the user gains the advantage of the stimulative effects both of the bombardment of the body by radiant heat and of the breathing of cool air.

With this introduction I want now to deal with the main part of my address, which concerns some of the reactions

* F.R.B. Technical Paper No. 12.

of the human body to radiant heat of appreciably higher intensity that has been considered in these introductory remarks.

We have seen that with air at a temperature of 55° F., comfort is attained with an intensity of radiant heat of 75 B.Th.U. per sq. ft. per hour. This is equivalent to approximately 0·34 grm. cals. per sq. cm. per minute. Later I shall deal with the reaction of the body to radiant heat of intensity 7 to 10 times as great as this. With energy of such intensity it becomes of interest to consider whether there is any difference in the sensations produced by different sources consequent upon variation in the quality, as distinct from the quantity, of heat received on the body.

Quality of the Energy Emitted by Different Sources.

The radiant heat emitted by any artificial source is very different from that emitted by the sun. Writers in the popular Press talk loosely of artificial sunshine, but a comparison of the emission spectrum of the sun with that of other sources will indicate that it is extremely difficult to produce a radiant energy exactly similar to that which reaches the earth from the sun itself. Although the artificial source of energy may be visibly or even dazzlingly hot, the major portion of the heat radiated is in the infra-red—that is to say, it is invisible radiant energy of a longer wave length than that of the range we term "light." The table below indicates the proportions of emitted energy from various sources falling within certain arbitrarily selected ranges.

TABLE I.

Source.	To 2μ.	2–3μ.	3–4μ.	4–5μ.	5–6μ	6–7μ.	7–8μ.
	%	%	%	%	%	%	%
Sun	90	6·9	1·6	1·2	0·3	0·0	0·0
Tungstem lamp in clear gas (100 w.)	69·7	22·0	5·8	2·0	0·0	0·0	0·0
Clinical gas lamp (disc type) . .	22·8	29·0	21·1	16·1	6·6	3·0	1·7
Cobble beam gas fire	16 9	24·0	21·7	17·9	10·4	6·0	3·1
Thermo beam gas fire	11·6	21·8	20·9	20·6	14·7	6·6	3·8
Dull red electric radiator . . .	6·4	19·1	24·8	23·1	14·1	7·5	5·0

These computations are based on the spectral emission curves after applying the dispersion correction, but have not been corrected for the differential reflections in the mirrors of the spectrometer.

It may be asked whether the heating of our bodies effected by sunshine on a summer's morning differs markedly from that occurring in front of the fire in our living rooms in winter. If there is no difference in the effects produced by visible energy, short infra-red and long infra-red energy, then there might be no difference between the sensations produced by sunshine and artificial heat, were it not for the ultra-violet energy received from the sun. So far as domestic heating appliances are concerned, any effects due to ultra-violet energy can be ignored. It is, of course, true that the Bunsen flame emits energy extending down to a wave length of 3,000 Angstrom units, and that the white-hot filament of a tungsten lamp has an emission spectrum extending into the ultra-violet, but the amount of the ultra-violet energy is so extremely small that its effects are negligible. Further, the intensity of the light emission of the tungsten filament is so high that glare is produced. On that score alone its use unscreened as a fire would be open to serious objection.

The skin of a person exposed to the sun ultimately becomes coloured brown. Generally speaking, the colour is uniform. If a naked or thinly clothed body is exposed to an artificial source of heat of sufficient intensity for a length of time, again a brown pigmentation results, but in this case the pigmentation is mottled. The general appearance of the colouring suggests that the effect which has caused this pigmentation, whatever it may be, is much more deep-seated in its action than that produced by the energy from the sun. The uniformity and sharp definition of the pigmentation caused by the sun, which is due to ultra-violet energy, suggests that it is a consequence of an effect on the capillary streams, whereas the mottled pigmentation produced by a fire may have its origin in some effect on the arterioles, which are more deeply seated. Both effects are probably stimulative.

The data in Table I. indicate that there are appreciable differences in the emission from different artificial sources of heat. With the tungsten lamp used, the peak of the emitted energy was at 1·3μ, whilst in the case of the gas fire employed, the first peak was at approximately 2·3μ. and the energy emitted extends further into the infra-red. In the case of the dull red electric heater, the peak was at 3·7μ. The question to be considered is whether differences of this sort in the quality of the energy will lead to any differences in the sensations experienced when the human body is exposed to such sources.

The better to understand the experiments to be described, it will be as well at this stage to give a short description of the structure of the human skin.

Structure of the Skin.

On the outer surface of the body is the dead horny layer of the epidermis, which varies in thickness from 0·02 mm. to 0·5 mm., and underneath are the living cells of the epidermis, in layers of thickness corresponding to the horny layers. The total thickness of the whole epidermis varies in general between 0·1 mm. and 1 mm., but may be even thicker in some people. Beneath the living cells is the derma, or true skin, in which blood circulates through a closely woven network of capillaries, in streams about 0·01 mm. thick. The nerve endings are in the living cells of the epidermis and in the derma. The derma is in general of the same order of thickness as the epidermis. The total thickness of the skin (epidermis and derma) varies between 0·5 mm. and 3·0 mm., but on the back and shoulders it may attain thicknesses as great as 5 or 6 mm.

Lewis, in his book, "The Blood Vessels of the Human Skin and Their Responses," states that it is in the most superficial parts of the skin directly beneath the actively growing epidermal cells that the final and most dense network of small blood vessels is meshed, spread out in a thin but complete sheet lying a millimetre or less below the surface. Through this probably the whole of the blood supply to the skin ultimately flows, presenting almost a maximum surface for dissipation of heat.

Variation in Endurable Time of Exposure to the Energy from Different Gas Fires.

Of recent years we have made changes in the design of gas fires with the object of increasing the proportion of short infra-red energy emitted. We find that when the amount of short infra-red energy is increased, more prolonged exposure to a given intensity of heat can be endured and at the same time the exposure feels more comfortable. The effect of such a change in the quality of energy is tested in the following way:

The two gas fires to be compared are arranged on a bench with suitable polished copper screens in front of them. In each of these screens there is cut a hole of 2½ cm. diameter, and on the side remote from the fire is arranged a felt-lined cradle at a suitable height to support a human arm behind the opening. The portion of the screen surrounding the hole is also felt-covered on the side remote from the fire. The positions of the fires are carefully adjusted so that the intensity of the energy passing through the opening in the screen is the same in each case. The naked arms of a number of people are then exposed in turn to each fire, the left arm to one fire and the right arm to the other. The person undergoing treatment is asked to comment on the sensations and to remove the arm when pain becomes acute, whilst a record is made of the comments expressed and the time. Results attained with a Thermo Beam fire (B) and a Cobble Beam fire (C) are summarized in Table II. It will be seen that although the times of exposure varied considerably, in all cases a longer exposure to fire C was endured than to fire B.

TABLE II.—*Relative Times of Exposure.*

	Subject.	Fire B.	Fire C.
		Secs.	Secs.
1	Female, fair	116	184
2	,, medium	120	153
3	,, ,, ...	133	244
4	,, dark	82	161
5	,, ,, ...	100	120
6	Male, very fair	141	167
7	,, fair	102	143
8	,, ,, ...	102	112
9	,, medium	100	131
10	,, ,, ...	88	108
11	,, ,, ...	224	245
12	,, medium to dark . .	131	153

Penetrancy Per Cent

—	Brown Bakelite.	Clear Bakelite.	Horn.
Fire B	6·5	6·6	9·3
Fire C	7·5	8·4	11·5

The heat emitted by these two fires differs in the proportion of short infra-red energy it contains. (See Table I.) This difference is represented by the penetrancy figures at the bottom of Table II.

(To be continued.)

Laboratory Assistance for Medium and Small Gas Undertakings*

By H. Rands, M.A., B.Sc., Wellington

The object of this paper is to initiate a discussion upon the desirability and practicability of increased laboratory assistance for the medium and small gas undertakings in New Zealand. By laboratory assistance is meant the carrying out and interpretation of the well-known routine gas-works tests and analyses based mainly upon the sciences of chemistry and physics; and for the purpose of this discussion, we may classify as "medium" those works making between 50 and 150 million c.ft. of gas per annum, and as "small" those producing less than fifty million. The larger works in the Dominion, outside this classification have for many years been equipped with laboratories staffed by qualified chemists, and have evidently found their employment profitable. The question herein raised is whether individually, or by some system of co-operation, the medium and small works could profitably utilize similar facilities.

In addition to the more obvious departments of gas manufacture in which chemical control tests are of value, there are continually cropping up in every works miscellaneous problems, such as those connected with corrosion, meter deposits, boiler feed waters, and the domestic and industrial utilization of gas and its bye-products, in the elucidation of which the assistance of the laboratory is essential.

One important fact which should be realized is that appreciation by engineers, and even by the general public, of the importance of scientific control of all industrial products has increased greatly in recent years. There is a more general knowledge (probably as the result of general science teaching in our schools and colleges) of the significance of the chemical and physical tests by which the quality and uniformity of products are estimated. In the author's experience actual analyses and other data with reference to gas, coke, tar, and its bye-products are asked for more frequently now than they were a few years ago. The Gas Regulations now enforce compliance with a specification as to calorific value, pressure, &c., and for road tars and several tar bye-products strict specifications must be adhered to.

A New Zealand Standards Institution was founded in July, 1932, to set up local standards for the engineering, electrical, chemical, and building industries, and it will, undoubtedly, have the effect of inducing both public bodies, and private firms and individuals to purchase only materials guaranteed to conform with the adopted standards.

This standardization movement aims at uniformity, simplification, and a general raising of the standard of industrial products, and will react to the general benefit of both buyer and seller; but an industrial works which is unable to test its raw materials or its products for itself must remain in a very disadvantageous position. Wherever we look, and, in particular, when we look at our competitors in the electrical, oil, and bitumen industries, we see the steady march of progress in technical efficiency, and we in the Gas Industry must either keep pace with this progress or go to the wall.

Practicability of Increased Laboratory Assistance.

While most managers of medium and small gas undertakings with whom the matter has been discussed admit the desirability of increased laboratory assistance, some hesitate on the question of practicability, stating that "it is all a question of £ s. d." Admittedly, money can be wasted upon over-elaborated as well as upon half-hearted laboratory routine testing, but on the other hand it has been repeatedly proved that under wise control, a comparatively small expenditure in this direction will yield a very high return. Without detailed inside information of the particular circumstances of each undertaking concerned, little can be done here beyond suggesting certain possible lines of action.

The initiative and the success of any action to be taken must naturally depend entirely upon the undertakings and managers concerned. Many managers are already doing a certain amount of routine testing themselves. It is obvious, however, that most have not the time, even if they had the facilities for systematic and thorough chemical testing. Most of the tests consume a good deal of time, and many of them, while apparently simple, when briefly outlined in a text book, really require a sound knowledge of the fundamental principles of chemistry and physics and constant practice in the technique of the laboratory if the results obtained are to be reasonably accurate, and correctly interpreted. Similarly, it is a great mistake to imagine that any intelligent youth, without previous thorough training in chemistry and physics, can be picked out from the present staff of an undertaking, armed with a small textbook on gas-works chemistry, labelled "Chemist," and, henceforth, be relied upon to supply all the chemical assistance necessary to the manager. In practice, gas-works chemistry is full of pitfalls not mentioned in the textbooks and demands a sound foundation of training in scientific methods, and considerable experience of the particular gas-making plant involved. A study of the Gas Engineering Syllabuses in the Education Scheme of the Institution of Gas Engineers of Great Britain will indicate the wide and thorough knowledge of physics and chemistry demanded. The only educational institutions at which the required training in these subjects is obtainable is at the university colleges, and the standard of the B.Sc. degree of the University of New Zealand should be regarded as the minimum required of a qualified gas-works chemist.

In these days of free education such a standard is widely accessible, and many young men, eager to enter upon an industrial career, secure this degree, annually, in New Zealand; but comparatively few of them are gaining admittance into the Gas Industry. In Great Britain, industrial concerns are looking more and more to the universities for the young men destined to occupy positions of responsibility.

The Bachelor of Engineering course provided at the School of Engineering at Canterbury College together with the chemistry course to the B.Sc. standard provide the best locally available educational foundation for a young New Zealander intending to enter the gas profession. In the case of a medium-sized gas-works unable to employ a full time chemist, a place might be found for a man with the above mentioned training, who could undertake all the chemical control testing required, and other general engineering work as well.

Co-operation for the Small Gas-Works.

For the small works, the solution would appear to lie in some system of co-operation. One is tempted to dream of the establishment of a first-class central gas laboratory, directed by a highly qualified gas engineer-chemist, and maintained by contributions from all medium and small gas-works, which are not able to provide laboratory facilities for themselves. Such an institution, controlled by the contributing undertakings, would be able to carry out all the necessary analyses and tests of materials forwarded, to pay regular visits to all works for special investigations, and to advise, generally, on all technical problems submitted. Were all the smaller undertakings throughout the Dominion under one ownership and control, some such scheme of co-operation and co-ordination would undoubtedly (in spite of the obvious difficulties) soon be devised and put into operation. But it must be admitted that under existing conditions, with works so widely separated, and with such disparity in size and in ownership of the undertakings concerned, there is little to encourage hope of success for a comprehensive scheme of this nature. Enthusiastic co-operation and skilful organization would be required to overcome difficulties, which would immediately arise, and the exercise of patient adherence on the part of every contributing undertaking to some kind of "Five Year Plan" would be necessary before the true benefits of such a scheme could be realized.

Co-operation on a less ambitious regional scale would, however, appear more readily attainable. In certain cases a medium-sized undertaking might feel justified in establishing a laboratory and employing a full-time chemist, if several small works within a geographically practical distance were willing to share the advantages and the expense on the basis of an annual contribution for a definite amount of work to be done. Without presuming to name particular undertakings, it may be said that examination of the geographical position of all the medium and small works will reveal several groups within which such a co-operative laboratory scheme could be a practical proposition.

Alternatively, certain medium or small undertakings

* Extract from paper before Tenth Annual Meeting of the Gas Institute of New Zealand, February, 1934.

might be able to arrange for larger works already possessing a laboratory and chemical staff to carry out their tests and to advise them on chemical problems. Here again the initiative would naturally have to come from the smaller works requiring assistance, and any arrangement would require to be for a definitely guaranteed amount of work per annum, and established upon a proper business basis.

At the present time, larger undertakings may render occasional assistance of this nature, but it is usually too haphazard to have any real and permanent effect upon the general efficiency of the smaller undertaking concerned. There are also, of course, consulting chemists in private practice willing to undertake analyses of materials for prescribed fees. But it should be obvious that, in general, private consulting chemists and public or semi-public laboratories are not in a position to advise as to how the results of their analyses or investigations are to be interpreted or applied to increase the efficiency of a works of which they have no practical working knowledge. The important point to be realized is that laboratory control work should not be occasional and haphazard, but regular and systematic.

Only thus will the benefits be certain, permanent, and cumulative in their effects. This desirable result is to be attained not by invoking occasional outside aid, but by steadily developing the necessary laboratory assistance for the medium and small undertakings from within the Gas Industry itself.

The Servicing of Gasholders*

By Herbert W. Alrich, Consolidated Gas Company of New York

The view has been expressed by some writers that the older holders built of wrought iron showed a superior resistance to corrosion when compared with those built later of steel. The high grade of the wrought iron produced in England has been recognized for centuries, but no such claim could be made for much of the metal produced in the United States in the earlier period of our industrial development. Some of the gasholders which I wrecked, after they had been in service for fifty years or more, were in a perfect condition, internally, and had withstood, externally, the ravages of corrosion. Other holders erected in the same period had obviously been built of inferior material. Most of the gasholders I have encountered, built during the last thirty-five years, appear to have been constructed of steel of such good quality that there can be no occasion for reverting to wrought iron.

Even though many satisfactory holders have been built of the water-sealed type, the advantages of a waterless design were apparent for many years before there was any solution to the problem of their design. It was evident that the elimination of the enormous weight of the tank water would effect a great reduction in the cost of foundations and permit the erection of holders at locations where the soil conditions were unfavourable for the support of heavy loadings. In addition, the tank water, after contamination by the gas, disfigures the paint and makes maintaining a sightly appearance an expensive and difficult objective. Furthermore, when a large gasholder is withdrawn from service for internal inspection, and/or repairs, the governmental restrictions on the pollution of streams may require an expenditure of fifteen to twenty thousand dollars for filtering the two million cubic feet of water which the tank may contain. In the large American cities this is a serious problem. Under the climatic conditions which prevail throughout the northern area of the American continent, and also the larger part of Europe, the water-sealed gasholder requires a considerable expenditure for steam heating and much vigilant attention during the prolonged periods of inclement weather.

Efforts were made, many years ago, to devise gasholders without water tanks. Obviously, the general arrangements of such a holder must include a shell or container of permanent height, with a disc or piston floating upwards or downwards in response to the changing volume of the contained gas. While the shell and piston offered no serious difficulties of design, the problem of the seal required to prevent the escape of gas between the periphery of the piston and the inner surface of the tank shell long defied solution. Many different piston seals were devised, some of which were quite ingenious, but none of them fulfilled the drastic requirements for such a seal until the development of the floating tar seal of the M.A.N. waterless holder.

The erection of this type of gasholder began in Germany, just prior to the World War. As their construction required much less metal than the water-sealed type, the scarcity of steel in Germany became a great incentive to their construction after 1915. In 1923, the advantages of the design having been demonstrated by the satisfactory operation of a number of M.A.N. holders in Germany, their adoption in other countries proceeded rapidly, until to-day there are, throughout the world, 254 of that type. These include a large number having capacities ranging from five million up to twenty million cubic feet. A holder, in Chicago, of the latter capacity, is the largest ever constructed. These 254 M.A.N. holders represent, collectively, nearly two thousand years of experience in such extremes of climatic conditions as obtain in Japan, Southern California, and Florida for heat, and those portions of North America and Europe where inclement winter weather prevails. Having had extended personal experience in the operation of the M.A.N. holders, and also water-sealed holders, throughout some very cold winters and some very hot summers, I can testify, without reservation, that the waterless holders have been entirely satisfactory and have some very substantial advantages. One winter's experience with both types of holder in a climate where the temperature is at or below zero for days, will remove all impression that water-sealed holders " can take care of themselves."

The usefulness of the water-sealed holders now in service is in no way impaired by the circumstance that another type has appeared which is more suitable for some locations and conditions. For future construction, the consideration of the water-seal holder for circumstances favourable to its type should not be precluded. In such cases the choice should be guided by good technical judgment and not by nervous emotions.

In an article in the " Gas Journal " for Oct. 25, 1933, Mr. R. J. Milbourne states that " The waterless gasholder is a type that inherently requires frequent inspection." He will be commonly understood as meaning that the waterless holder requires more attention than is necessary for the water-sealed type. Such a conclusion would be in direct conflict with my own experience and opposed by the facts wherever I have been able to ascertain them. It may be true that some operating engineers do bestow more attention upon a waterless than they do upon the water-sealed holder, but this only evidences their state of mind and not the requirements. I have assisted in the enlightenment of several apprehensive men who were still struggling through their " honeymoon " experience with the waterless holder, and whose only operating difficulties consisted in their inexperience, lack of confidence in themselves, and gloomy expectations. A judgment, as to whether one type of gasholder requires more inspection, maintenance, and supervision than another must rest upon the actual facts and not a mere opinion. I encountered one operating engineer who alleged that his waterless holder required much more attention than did the water-sealed type. From interrogating him at some length, I learned that his water-sealed holders had been neglected for years. He followed no routine for inspecting the cups or sounding for rubbish in the tanks. The unlubricated guide rollers were frozen to the spindles with corrosion, and the guard railings on some stairways and platforms were collapsing from rust.

Even though the waterless type of holder, provided with a floating tar seal, has been demonstrated to be safe and reliable by nearly two thousand years of collective experience under a variety of operating conditions, there still appears occasional echoes of mistrust. This scepticism is of the same psychological parentage as was the outcry against overground steel tanks and multiple lifts for water-sealed holders. When I entered the Gas Industry, but few large holders of such design had been built, but many more were soon to be constructed.

The operating gas engineer of that day was usually a rugged elderly gentleman, who evidenced his competence by conservatism and hostile resistance to everything new. To these men of thirty years ago, the large steel tank was a forerunner of disaster. In their opinion all such tanks

* From a paper before 27th Annual Convention, Canadian Gas Association, 1934.

would, eventually, be wrecked by irregular settlement, anchor ice or electrolysis. We may now look back over a full generation of time without being able to recall a single instance of a large steel holder tank having been wrecked by the forms of destruction so real in the imagination of these men. Some of the lineal descendants of these old conservatives are to-day decrying the waterless holder, though many have already learned better and others are on the way.

All types of containers for the storage of inflammable gas require, for safe operation, intelligent supervision by competent men. Such competence is only to be acquired by training. It cannot be imparted to a man by providing him with printed rules. Any man, so unfamiliar with his work as to require a memorandum, is incompetent to operate gasholders. In my own jurisdiction, all men assigned to the operation of gasholders of any type are trained for the work, and are not permitted to have either printed or written rules, other than such memoranda as they may make for themselves. That any type of gasholder is "foolproof" and can take care of itself is a malicious delusion.

During the early years of their operation it was frequently suggested that greater safety could be obtained by the addition to waterless holders of various so-called safety attachments. Very strangely these gadgets were usually devised by those who had never operated a M.A.N. holder and who were not well grounded in the principles of its construction and adjustment. As a consequence of such unfamiliarity, the devices merely represented some inexpert impression of the designers as to their merits and contributed no additional safety whatever. It will, doubtless, be agreed that any such attachment, the purpose of which is to prevent mishaps, must be contrived to meet some definite situation. This can only be accomplished after a consideration of past experience. Otherwise the design will be aimless and based upon unreal and speculative assumptions. I have condemned all such gadgets for several reasons, among which is the fact that they were not based upon anything that has ever happened in the operation of a waterless holder and, being misleading in their purport as safety factors, would encourage negligence in routine inspection. These proposals originate in an assumption that the design of the waterless holder is incomplete, when, as a matter of fact, all possibilities received the most thorough study, and all necessary safety features are incorporated in the structure when built.

What follows sets forth the existing practice in the supervision of the gasholders under my jurisdiction.

Practice in the Supervision of Gasholders.

All inspection, operation, and maintenance is under the personal direction of competent supervisors, designated by a responsible operating official.

All inspections are controlled by appropriate forms, which indicate definitely the extent of the inspection to be made with space provided for the report of findings relative to each item covered. These reports receive the prompt attention of the responsible operating official in order that when any conditions appear to need correction, the necessary instructions can immediately be issued. In such cases they are ultimately filed as a record of the completion of the work.

Special Equipment.

The following first-aid equipment is provided and readily accessible for all operations on or about holders:

For waterless holders:

2 woollen blankets on piston.
2 woollen blankets on balcony.
4 extra cylinders of 93% O_2 and 7% CO_2 on piston.
4 extra cylinders of 93% O_2 and 7% CO_2 on balcony.
1 inhalator on piston.
1 inhalator on balcony.

A sufficient number of canister type of gas masks are provided for each man regularly employed in connection with the holders. All workmen are instructed in the Schafer method of resuscitation, annually.

Safeguards Against Fire.

When practicable and desirable, local operation and control of inlet, outlet, and by-pass valves is supplemented with control from a point remote from the holder.

Water hydrants are so located as to ensure an ample supply of water in case of fire in the vicinity of gasholders. All company-owned buildings, adjacent to a holder, are properly safeguarded against fire, are of fire-resisting construction, and no oil, other than lubricating oil, or other highly inflammable material is stored therein. No temporary structures are permitted within 50 ft. of any holder.

Properties on which holders are located are adequately fenced and the gates properly guarded.

All gas piping in proximity to the holders is underground.

Inspections.

The frequency of the inspections described below are determined for each situation and depend on the location, the kind of gas, the type and size of the holder, season of the year, and other factors. As determined, a regular schedule of inspections is prescribed and followed.

Complete and detailed examination of entire holder structure, by trained inspectors, is made once a year, with complete reports for the attention of the vice-president in charge of engineering.

Inspections include tests of opening, closing, and leakage of inlet, outlet, by-pass, and all controlled valves on piping adjacent to holder. When practical a full opening and closing test is made. There are frequent inspections of this character. In freezing weather the temperature of the water in holder cups is recorded at least twice a day. The depth of water in cups is recorded when the temperature is taken during freezing weather, and at other times at least once a day.

When in operation, apparatus for heating holder cups is inspected at least twice a day. Guide rollers are inspected at sufficiently frequent intervals to ascertain whether they are providing proper guidance and whether they are adequately lubricated.

Waterless Holders.

Crews for interior inspections of waterless holders consist of at least three men, one of whom is a foreman or his immediate assistant.

During inspections the general practice throughout gasworks is observed, in that one man is never allowed to go on the piston alone. Two men go on the piston. One man remains on the upper landing or gallery in such a position as to be able to communicate with the men on the piston at all times. Toxic fumes from the tar are thus guarded against.

Atmosphere Above Piston.

Periodic tests are made of the atmosphere above the piston. The depth of tar seal and the piston level are observed at least once a day, but such inspections are more frequent when the atmospheric temperature is below 26° F. to observe any tendency of the tar to emulsify. A complete report of all operating conditions is made daily.

The inspection of mechanical equipment covers guide rollers, grease cups, folding ladders, tar and skimmer pumps, tar conditioner, and other mechanical equipment.

The inspection of the elevators covers tests of inside and outside elevator safety devices, cables, hoists, rope-baskets, drums, sheaves, &c. These inspections are made by trained elevator inspectors accompanied by a representative of the company. The pressure relief valves are frequently inspected and are maintained in operating order. An annual examination is made of the piers or saddles, the irregular settlement of which will deprive the tank of even support.

Maintenance.

The use of cutting and welding torches is not permitted, unless extraordinary precautions against fire and explosion have been taken. No gas or electric welding is attempted upon a pressure tank. A pressure tank is not caulked with air tools until the pressure within it is below 5 lbs. Major maintenance work involving all holders, valves or pipe connections is done in accordance with the American Gas Association's recommended Procedure for the Purging of Gasholders. A definite and detailed plan in writing for such maintenance work is developed and agreed upon by the construction and operating personnel before the work is undertaken. After approximately twenty-five years of service, each water-sealed holder is placed out of commission, the tank emptied, and a thorough internal inspection made, followed by the indicated repairs. At such times the internal rollers, which are not accessible while the holder is in service, are overhauled and adjusted.

During the progress of minor maintenance work, all safety precautions customarily prevailing in gas plant operations, as well as those recommended above, under the head of inspections, are rigidly adhered to. Throughout the gas-works, smoking by employees and open-flame lights are prohibited, except in retort houses, generator houses, boiler houses, and blacksmith shops.

INSTRUMENTS

CALORIMETERS

Simmance Patent "Positive Record" Gas Calorimeter.
Simmance Patent Total Heat Calorimeter, Sheffield Pattern.
Simmance Patent Total Heat Calorimeter, Canadian Pattern.
Simmance Patent Calorgraph.
Simmance Patent Indicating Calorimeter.
Boys' non-recording Calorimeter.
"Junkers" non-recording Calorimeter.
Also Portable Calorimeter, and Oil Calorimeter (for light oils and spirit).

SPECIFIC GRAVITY (OF GAS) APPARATUS

Simmance Patent Recording Gravitometer.
Simmance Patent Indicating and Recording Gravitometer.
Simmance Specific Gravity Bell.
Schilling's Diffusion Apparatus.

PRESSURE AND VACUUM GAUGES

Simmance Patent Dead-Beat Indicators, fixed and portable.
Simmance Patent Dead-Beat Recorders, disc-chart, fixed and portable, "Large Drum," "Light Weight," continuous tape chart, twin chart.
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SOLID FUEL CALORIMETER "Roland Wild."

Further particulars and prices on application.

1843

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1934

Gas Markets and Manufactures

Stock Market Report.

[For Stock and Share List, see later page.]

The usual end-of-the-Account dullness was conspicuous by its absence last week, as markets were particularly active. A large volume of business was done in gilt-edged securities and in well-secured preference and debenture issues, while in the Industrial market Tobaccos were in heavy demand and prices moved up. A satisfactory feature was an all-round improvement in Home Rails on the publication of the wages settlement.

Despite the short week, a good volume of business was also recorded in Gas stocks and shares, and several stocks substantially appreciated. A sharp rise of 12 points occurred in Bournemouth sliding-scale stock to 217½. Business was done early in the week at 211 and latterly at 219, while a small parcel is now on offer at 220, yielding £4 6s. 4d.%. On the local Exchange, Newcastle units rose 7½d. to 26s. 7½d.; Colombo 7% preference shares hardened 6d. to 20s. 6d.; Imperial Continental 3½% debenture improved 4 to 94½; and it will be seen in the Stock and Share List that several other smaller improvements took place.

At the time of writing there are two large parcels available in the preference group—viz., 18,400 £1 4½% cumulative shares of the Associated Gas and Water Undertakings, which are offered at 21s., free of expense, yielding £4 5s. 8d.%, and £35,000 Watford and St. Albans 5% (5 months' dividend being payable in February next) is offered at 124, also free of expense, the yield in this case working out at £4 0s. 7d.%.

In the ordinary group, with the exception of Gas Light units and Imperial Continental, there is very little stock available of the larger undertakings, but several parcels are offered of stocks not usually readily obtainable—viz., £1,480 Rhymney and Aber (6% dividend) at 119, yielding £5 0s. 10d.%; £388 Shanklin and Ventnor (8% dividend) at 170, yielding £4 14s. 1d.%, and £400 Shotley Bridge 5% maximum at 108, yielding £4 12s. 7d.%. Among those Companies operating abroad there are 10,000 Hong Kong and China £1 shares on offer at 30s., yielding, on an 8% dividend, £5 6s. 8d.%, and £5,000 Montevideo stock at 65, which, on a dividend of 3%, free of tax, brings in 6%.

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *Aug.* 13.

The values of tar products remain at the following levels:
Pitch, about 57s. 6d. per ton f.o.b.
Creosote, 4d. to 4¼d. per gallon.
Refined tar, 4d. to 4¼d. per gallon in bulk at makers' works.
Pure toluole, about 2s. 2d. to 2s. 3d.; pure benzole, 1s. 9d. to 1s. 10d.; 95/160 solvent naphtha, 1s. 7d. to 1s. 8d.; and 90/160 pyridine, 7s. to 7s. 6d.—all per gallon naked at makers' works.

Tar Products in the Provinces.

Aug. 13.

The average prices of gas-works products during the week were: Gas-works tar, 25s. to 30s.; Pitch—East Coast, 55s. to 57s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 55s. to 57s. 6d.* Toluole, naked, North, 1s. 9d. to 1s. 11d. Coal-tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha. North, 9¾d. to 10¾d. Creosote, *ex* works, in bulk, North, liquid and salty, 3⅛d. to 3⅜d.; low gravity, 3⅛d. to 3⅜d.; Scotland, 3d. to 3¼d. Heavy oils, in bulk, North, 3⅜d. to 4¼d. Carbolic acid, 60's, 1s. 11d. to 2s. 1d. Naphthalene, £10 to £11. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Aug.* 11.

There is fair activity in most products and prices remain steady. Both refined tar and pitch are, however, difficult to sell, but creosote oil holds its own.

Crude gas-works tar.—The actual value remains at 34s. to 36s. per ton *ex* works in bulk.

Pitch is not commanding much attention and value is in the region of 45s. per ton f.o.b. Glasgow for export and 42s. 6d. to 45s. per ton *ex* works in bulk for home trade.

Refined tar.—Throughput is disappointing, but makers are still holding for 3d. to 3¼d. per gallon naked at works.

Creosote oil.—Available supplies are well looked after and quotations for all grades are firm. B.E.S.A. Specification oil is 4d. to 4¼d. per gallon; low gravity, 4½d. to 4¾d. per gallon; and neutral oil, 4¼d. to 4½d. per gallon; all f.o.r. in bulk.

Cresylic acid.—A steady business is being conducted in all grades. Pale, 97/99%, is 1s. 3d. to 1s. 4d. per gallon; dark, 97/99%, 1s. 0½d. to 1s. 1½d. per gallon; and pale, 99/100%, 1s. 4½d. to 1s. 5½d. per gallon; all *ex* works.

Crude naphtha remains steady at 4¾d. to 5¼d. per gallon, according to quality.

Solvent naphtha.—90/160 grade is 1s. 3d. to 1s. 4d. per gallon, and 90/190 grade 8d. per gallon.

Motor benzole.—Value is nominal at 1s. 5d. per gallon.

Pyridines.—90/160 grade is 6s. to 7s. per gallon, and 90/140 grade 7s. to 8s. per gallon (nominal).

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.		
Crude benzole	0	9	to	0	9½	per gallon at works	
Motor ,,	1	3½	,,	1	4	,,	,, ,,
90% ,,	1	4	,,	1	4½	,,	,, ,,
Pure ,,	1	7½	,,	1	8	,,	,, ,,

Trade Notes.

W. J. Jenkins & Co., Ltd.

We have received from Messrs. W. J. Jenkins, of Retford, Notts., a copy of their recently published brochure dealing with some notable features of their system of carbonization, which has been progressively installed and developed since 1908. The system, combining efficiency with simplicity, is suitable for any gas-works whose annual make is upwards of 20 millions.

Contracts Advertised To-Day.

Coal.
Teignmouth Gas Department. [p. 375.]

Coke Grading Plant.
Colwyn Bay Gas Department. [p. 375.]

Condenser.
Thornton Cleveleys Gas Department. [p. 375.]

Gasholder Repairs.
Teignmouth Gas Department. [p. 375.]

Gasholders and Tanks, &c.
Borough of Morecambe and Heysham. [p. 375.]
Thornton Cleveleys Gas Department. [p. 375.]

Meter (Connersville Type).
Thornton Cleveleys Gas Department. [p. 375.]

Pipes, &c.
Thornton Cleveleys Gas Department. [p. 375.]

Producer Gas Plant.
Thornton Cleveleys Gas Department. [p. 375.]

Purifiers, &c.
Thornton Cleveleys Gas Department. [p. 375.]

Station Governor.
Thornton Cleveleys Gas Department. [p. 375.]

Tar Extractor.
Thornton Cleveleys Gas Department. [p. 375.]

Fertilizer Prices.

Imperial Chemical Industries give the following announcement of home prices of fertilizers:

Sulphate of Ammonia.—The price for neutral quality, basis 20·6% nitrogen, for delivery to farmer's nearest station carriage paid in 6-ton lots is: August, £6 14s. 6d. per ton; September, £6 16s.; October, £6 17s. 6d.; November, £6 19s.; December, £7 0s. 6d.; January, £7 2s.; February, £7 3s. 6d.; March/June, £7 5s. per ton.

Nitro Chalk.—The price of this product, basis 15·5% nitrogen, for delivery up to June, 1935, in 6-ton lots carriage paid to farmer's nearest station is unchanged at £7 5s. per ton.

Nitrate of Soda.—The price for this product, basis 15½% or 16% nitrogen, for delivery up to June, 1935, in 6-ton lots carriage paid to farmer's nearest station is £7 12s. 6d. per ton.

Worcester

The installation of 12 Glover-West continuous vertical retorts, with an estimated daily gas-making capacity of 1,080,000 c.ft., inaugurated on July 10th, 1934, at the works of the Worcester New Gas Light Company.

The latest installation of Glover-West verticals to be put into service . . .

In this country and in countries overseas there are now 9,900 vertical retorts of the Glover-West continuous type meeting the gas requirements of 230 cities and towns. The estimated total daily gas production of these retorts exceeds 520 million cubic feet. And almost all installations are served by West's coal and coke conveying, cutting, grading, and storage plant designed for maximum efficiency in working results.

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Glover-West continuous vertical retorts . . . . West-vertical semi-intermittent chambers . . . . The West lip-bucket conveyor with automatic lubrication . . . . All types of modern coal and coke breaking, grading, and conveying plant . . . . Wagon-tippers . . . Telpher plants . . . . Breeze-burning producers . . . . Waste-heat recovery equipment.

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LONDON: REGENT HOUSE, KINGSWAY, W.C.2 'Phone: Holborn 4108

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. Aug. 10.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,351,868	Stk.	Apl. 9	7	7	Alliance & Dublin Ord. ...	130—140	...	...
374,000	„	June 25	4	4	Do. 4 p.c. Deb. ...	90—100	...	...
557,655	„	Mar. 5	7	7	Barnet Ord. 7 p.c.	167—172	...	...
300,000	1	May 7	1/4½	1/9¾	Bombay, Ltd.	27/6 -29/6	...	...
178,480	Stk.	Feb. 19	9½	9½	Bournemouth sliding scale	215—220	+12	211 219
550,050	„	„	7	7	Do. 7 p.c. max. ...	168 —173	+1	170—172
439,160	„	„	6	6	Do. 6 p.c. Pref. ...	142—147	...	145—146½
50,000	„	June 11	3	3	Do. 3 p.c. Deb. ...	78—83	...	...
262,025	„	„	4	4	Do. 4 p.c. Deb. ...	103—108	...	10[illegible]
335,000	„	„	5	5	Do. 5 p.c. Deb. ...	122 —127	...	123
357,900	„	Mar. 5	7½	7½	Brighton, &c., 6 p.c. Con. ...	162—167	...	...
540,000	„	„	6½	6½	Do. 5 p.c. Con. ...	151—156	...	...
195,500	„	„	6	6	Do. 6 p.c. B. Pref.	140—145	...	...
1,487,500	„	July 9	5	5	Bristol 5 p.c. max.	116 -118a	...	...
120,420	„	June 11	4	4	Do. 1st 4 p.c. Deb. ...	102 -105a	...	...
217,870	„	„	4	4	Do. 2nd 4 p.c. Deb. ...	102 -105a	...	...
328,790	„	„	5	5	Do. 5 p.c. Deb.	121 -123a	...	...
855,000	„	Apl. 9	7	8	British Ord.	155 - 160	...	160
100,000	„	June 11	7	7	Do. 7 p.c. Pref.	154 - 159	...	...
350,000	„	„	5½	5½	Do. 5½ p.c. Pref.	104 - 109	...	...
120,000	„	„	4	4	Do. 4 p.c. Red. Deb. ...	95 -100	...	...
450,000	„	„	5	5	Do. 5 p.c. Red. Deb. ...	107 -112	...	...
160,000	„	June 11	5	5	Cambridge 5 p.c. Deb. ...	115 -120	...	...
100,000	10	23 May '33	6	4	Cape Town, Ltd.	2—4	...	...
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref. ...	5 - 7	...	...
150,000	Stk.	July 23	4½	4½	Do. 4½ p.c. Deb. ...	90 95	...	...
626,860	„	July 23	6	6	Cardiff Con. Ord.	129 -133*	+2½	129—132
237,860	„	June 11	5	5	Do. 5 p.c. Red. Deb.	108—108	...	...
157,150	„	July 23	6½	5	Chester 5 p.c. Ord.	113 118d*	...	...
98,936	1	May 7	2/-	2/-	Colombo, Ltd. Ord.	1[illegible] -1[illegible]	...	...
24,500	1	„	1/4½	1/4½	Do. 7 p.c. Pref. ...	19/6 21/6	+-/6	...
609,204	1	Mar. 19	/11'48	/11'48	Colonial Gas Assn. Ltd. Ord.	19/6 - 21/6	...	...
296,058	1	„	1/8'80	1/8'80	Do. 8 p.c. Pref.	23/6 - 25/6	...	...
1,775,005	Stk.	July 23	6½	5	Commercial Ord.	118 -123*	...	121
475,000	„	June 11	3	3	Do. 3 p.c. Deb. ...	82 - 87	...	83—86
286,344	„	Mar. 5	5	5	Do. 5 p.c. Deb. ...	120 -125	...	124
807,560	„	Feb. 19	7	7	Croydon sliding scale ...	154 - 159	...	...
569,590	„	„	5	5	Do. max. div.	105 -110	...	...
620,345	„	June 25	5	5	Do. 5 p.c. Deb.... ...	119 -124	...	...
542,270	„	Mar. 5	7	10	Derby Con.	175 - 180e	...	...
55,000	„	June 25	4	4	Do. 4 p.c. Deb.	97 - 100e	...	...
209,000	„	Feb 19	5	5	East Hull Ord. 5 p.c. ...	106 -111	...	...
181,625	„	Mar. 5	6	6	East Surrey Ord. 5 p.c. ...	126 - 131	...	...
175,609	„	June 11	5	5	Do. 5 p.c. Deb. ...	120 -125	...	...
1,002,180	„	Apl. 9	†5	†7	European, Ltd.	125 - 130	...	126½
19,342,763	„	Feb. 19	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	27/- -27/6f	...	26/6—27/4½
2,600,000	„	„	3½	3½	Do. 3½ p.c. max. ...	88 -91	+1	89½—90½
4,477,106	„	„	4	4	Do. 4 p.c. Con. Pref. ...	105 -108	...	107
6,102,497	„	May 28	3	3	Do. 3 p.c. Con. Deb. ...	85 -88	...	87⅛—87⅞
3,642,770	„	„	5	5	Do. 5 p.c. Red. Deb. ...	115 -118	...	117—118
3,500,000	„	„	4½	4½	Do. 4½ p.c. Red. Deb. ...	113 -116	...	114—115
270,456	„	Mar. 5	6	6	Harrogate New Cons. ...	129 -134	...	...
82,500	„	Mar. 5	7	7	Hastings & St. L. 5 p.c. Conv.	147 -152	...	...
258,740	„	„	5½	5½	Do. 3¾ p.c. Conv.	118 -123	...	...
140,000	1	Apl. 23	1/7½	1/7½	Hongkong & China, Ltd. ...	1[illegible] -1[illegible]	...	...
213,200	Stk.	Mar. 5	6	6	Hornsey Con. 3½ p.c. ...	128 -133	...	...
5,600,000	„	May 28	10	14	Imperial Continental Cap.	205 -215	...	205½—207½
223,130	„	July 23	3½	3½	Do. 3½ p.c. Red. Deb.	92 -97*	+4	92
235,242	„	Mar. 5	8½	8½	Lea Bridge 5 p.c. Ord. ...	169 -174	...	...
9,167,410	„	Mar. 5	6	6	Liverpool 5 p.c. Ord. ...	133 -134b	...	...
245,500	„	June 11	5	5	Do 5 p.c. Red. Pref. ...	101—111b	...	...
306,083	„	July 16	4	4	Do. 4 p.c. Deb. ...	100½ -102½b	...	...
165,736	„	Feb. 19	8	10	Maidstone 5 p.c. Cap. ...	180—190	...	...
56,176	„	June 25	3	3	Do. 3 p.c. Deb. ...	71—76	...	...
75,000	„	May 28	†10	†10	Malta & Mediterranean ...	200—210	...	...
393,000	—	Apl. 3	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	98—103	...	...
231,978	Stk.	Feb. 19	5	5	M. S. Utility "C." Cons. ...	113—118	...	...
818,657	„	„	4	4	Do. 4 p.c. Cons. Pref.	96 -101	...	...
360,075	„	June 11	4	4	Do. 4 p.c. Deb. ...	100—105	...	...
148,955	„	„	5	†5	Do. 5 p.c. Deb. ...	119 -124	...	...
125,000	—	July 2	...	11/8	Do 3½ p.c. Rd. Rg.Bds.	97—100	...	...
675,000	„	May 28	†6	†13	Montevideo, Ltd.	60 -65	...	60½—62
9,061,315	„	Mar. 5	5	6⅔	Newcastle & Gateshead Con.	26/3 -27/-df	+-/7½	...
682,856	„	„	4	4	Do. 4 p.c. Pref. ...	101—102d	...	...
776,706	„	June 11	3½	3½	Do. 3½ p.c. Deb. ...	90½ -91½d	...	...
277,285	„	May 7	5	5	Do. 5 p.c. Deb. '43 ...	105—107d	...	...
274,000	„	Feb. 19	5	5	Newport (Mon.) 5 p.c. max.	107—109a	...	...
204,940	„	Mar. 19	7½	7½	North Middlesex 6 p.c. Con.	155—160	...	...
336,160	„	Feb. 5	5	5	Northampton 5 p.c. max. ...	104—109	...	...
300,000	„	May 7	†9	†7	Oriental, Ltd.	155—160	...	...
416,617	„	June 11	8	8	Plym'th & Stonehouse 5 p.c.	167—172	...	...
504,416	„	Feb. 19	8	8	Portsm'th Con. Stk. 4 p.c. Std[e]	168 -173	...	...
241,446	„	„	5	5	Do. 5 p.c. max. ...	105 -110	...	...
114,000	„	July 23	5	5	Preston 5 p.c. Pref.	101—106*	...	...
1,736,968	Stk.	Mar. 19	6	6	Sheffield Cons.	139 -141e	...	...
95,000	„	July 9	4	4	Do. 4 p.c. Deb.	100 -101e	...	...
133,201	„	Feb. 19	8½	5	Shrewsbury 5 p.c. Ord. ...	137—142	...	...
90,000	10	May 28	‡4	‡3	South African	2—4	...	...
889,095	1	May 7	1/4⅜	1/2⅝	South East'n Gas Cn. Ld Ord.	27/9—28/9	...	28/—28/9
736,061	1	Apl. 9	-/10½	-/10½	Do. 4½ p.c. Red. Cum. Pref.	21/9—22/9	...	...
450,000	Stk.	Feb. 12	—	74/4	Do. 4 p.c. Red. Deb. ...	101—103	...	...
6,709,895	„	Feb. 19	5	7	South Met. Ord.	136—139	+1	136—138½
1,135,812	„	„	6	6	Do. 6 p.c. Irred. Pf.	142—147	...	...
850,000	„	„	4	4	Do. 4 p.c. Irred. Pf.	103—107	...	...
1,895,445	„	June 25	3	3	Do. 3 p.c. Deb ...	84 - 87	...	86½
1 000,000	„	July 9	5	5	Do. 5 p.c. Red. Deb.	113 -116	...	...
209,820	„	Mar. 5	8½	8½	South Shields Con.	166—168d	...	...
1,543,795	„	July 9	6	6	South Suburban Ord. 5 p.c.	133 -136	+1	134 - 135
512,825	„	„	5	5	Do. 5 p.c. Pref.	120—125	...	...
300,000	„	„	4	4	Do. 4 p.c. Pref.	101—106	...	...
868,837	„	June 11	5	5	Do. 5 p.c. Deb.	121—126	...	121
100,000	„	„	4	4	Do. 4 p.c. Deb.	102—107	...	...
647,740	„	Mar. 5	5	5	Southampt'n Ord. 5 p.c. max.	110 -115	...	...
121,275	„	June 11	4	4	Do. 4 p.c. Deb.	99 -104	...	...
350,000	„	Mar. 5	5½	5½	Swansea 5½ p.c. Red. Pref.	107—112	...	...
200,000	„	June 11	6½	6½	Do. 6½ p.c. Red. Deb.	100 -105	...	...
1,076,490	„	Mar. 5	6½	6½	Tottenham and District Ord.	154 -159	+1	155—157
409,835	„	„	5½	5½	Do. 5½ p.c. Pref. ...	126—131	...	129½
62,235	„	„	5	5	Do. 5 p.c. Pref. ...	115 -120	...	...
199,005	„	June 11	4	4	Do. 4 p.c. Deb. ...	98 -103	...	...
349,110	„	Mar. 5	7	7	Uxbridge, &c., 5 p.c. ...	151—156	...	...
88,330	„	„	5	5	Do. 5 p.c. Pref. ...	112 -117	...	...
1,322,220	„	Mar. 5	7	7	Wandsworth Consolidated	157—162	...	157½—161½
1,096,373	„	„	5	5	Do. 5 p.c. Pref.	121—126	...	123—124
1,317,964	„	June 11	5	5	Do. 5 p.c. Deb.	121—126	...	124—126
158,400	„	Mar. 5	5	6σ	Winchester W. & G. 5 p.c. Con.	115—120	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock *g.*—Paid £3, including 10s. on account of back dividends. * Ex. div. † Paid free of income-tax. ‡ For year.

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